BSR/ASHRAE/IES Addendum cd
to ANSI/ASHRAE/IES Standard 90.1-2016

Public Review Draft

Proposed Addendum cd to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings

First Public Review (February 2019)
(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 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 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.

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(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

Section 6.5.6.1 currently reads as follows in the 90.1 standard.

6.5.6.1 Exhaust Air Energy Recovery

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

The Mechanical Subcommittee proposes a change to this section to clarify the requirement underlined in the final sentence. The reason for this proposed change is that there are no requirements defining what the bypass or control must accomplish in order to save energy.

Statement on Potential Energy Impact:
The proposed addenda will save energy in two ways:

1) *Eliminate energy exchange in economizing mode that reduces the effectiveness of economizing.*
2) *Reduce the pressure drop through the energy recovery system in economizing mode.*

This addenda is intended to be primarily a clarification of the original intention for bypass and control to permit economizer operation. The Bypass working group evaluated several systems and found that with this proposal, a more clear control strategy is required where energy recovery systems are installed. Controls are already required by the standard; however, in some cases compliance with the existing standard may result in less than optimum economizer operation and increased fan energy use.

Potential cost impact: The clarified requirements may require two bypass dampers rather than one in some cases. Depending upon design choices, cost may vary, and for an example review, the clarification is deemed to require the cost of one additional damper at around $600 for a 5 ton cooling system. Five tons of cooling is near the minimum capacity where an economizer is required and savings are expected to be least at this capacity. A simple analysis was conducted based on loss of 50% economizer savings and a change of 1.2” static pressure in one airstream during times of economizer operation. Climate zones 6b, 4c and 2b were analyzed using a simplified bin calculation, with the resulting annual savings ranging from $115 to $139 and the resulting scalar payback period ranging from 4.4 to 5.3 years. Since all the scalar paybacks from this simple analysis were less than half the scalar threshold of 12 years required for a 15 year life, further more sophisticated analysis was not pursued. It should be noted that the cost is relatively high for the minimum capacity unit reviewed where the provisions would apply, and that for larger units the cost would be a smaller proportional savings.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (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.]

Note to reviewers: This section has several related addenda. Therefore per standard work, an underline/strike through version based on 2016 version of 90.1 is followed by a clean version with all approved addenda considered.

Addendum cd to 90.1-2016

Modify the standard as follows (IP and SI Units)

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. 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* requiring dehumidification that employ *energy* recovery in series with the cooling coil.
8. *Systems* expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table 6.5.6.1-1.

6.5.6.1.1 Minimum Enthalpy Recovery Ratio

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.

6.5.6.1.2 Provision for Air Economizer or Bypass Operation
Provision shall be made for both *outdoor air* and exhaust air to bypass or control the *energy* recovery *system* to enable *economizer* operation as required by Section 6.5.1.1. The bypass or *control* shall meet the following criteria:

a. For *energy* recovery *systems* where the transfer of *energy* cannot be stopped, bypass provision shall prevent the total airflow rates of both *outdoor air* and exhaust air through the *energy* recovery *system* from exceeding 10% of the full design airflow rate.
b. The pressure drop of the *outdoor air* through the energy recovery system shall not exceed 0.4 in. H_2O (100 Pa); the pressure drop of the exhaust air through the energy recovery system shall not exceed 0.3 in. H_2O (75 Pa).

Exceptions to 6.5.6.1.2

1. *Energy* recovery *systems* with 80% or more *outdoor air* at full design airflow rate and not exceeding 10,000 CFM (4.72 m^3/s).

NOTE TO REVIEWER: In addition to approved addenda H and AM, Section 6.5.6.1 is ***pending modification by addenda DN and AY****. The following shows how section 6.5.6.1 will appear when* ***this addendum and addenda DN, H, AM and AY are combined,*** *if addenda AY and DN are approved. Additional changes needed to combine this addendum with prior addenda are shown in strikeout and underline. Such changes do not change the substantive nature of prior approved addenda (just relocation of some text and renumbering) and are not available for comment.*

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 steam 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 and the dry bulb temperature of the air leaving the dehumidifying cooling coil.

enthalpy recovery ratio: change in the enthalpy of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air enthalpy, expressed as a percentage.

nontransient: occupancy of a dwelling unit or sleeping unit for more than 30 days.

6.5.6.1 Exhaust Air Energy Recovery

6.5.6.1.1 Nontransient dwelling units
Nontransient dwelling units shall be provided with *outdoor air* energy recovery ventilation systems. For *nontransient dwelling units*, *energy* recovery *systems* shall result in an *enthalpy recovery ratio* of at least 50% at cooling design condition and at least 60% at heating design condition. 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.

Exceptions to 6.5.6.1.1:

1. *Nontransient dwelling units* in Climate Zone 3C.
2. *Nontransient dwelling units* with no more than 500 ft^2 of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C, and 5C.
3. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1, and 2.
4. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 4, 5, 6, 7, and 8.

6.5.6.1.2 Spaces other than nontransient dwelling units
Each fan *system* serving spaces other than *nontransient dwelling units* shall have an *energy* recovery *system* where ~~when~~ the design supply fan airflow rate exceeds the value listed in Tables 6.5.6.1.2-1 and 6.5.6.1.2-2,

based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table 6.5.6.1.2-1 shall be used for all *ventilation systems* that operate less than 8000 hours per year, and Table 6.5.6.1.2-2 shall be used for all *ventilation systems* that operate 8000 or more hours per year.

~~For spaces other than *nontransient dwelling units*, e~~ 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.~~

Exceptions to 6.5.6.1.2

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. *Enthalpy recovery ratio* requirements at heating *design condition* in Climate Zones 0, 1, and 2.
5. *Enthalpy recovery ratio* requirements at cooling *design condition* 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 air 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. Heating energy recovery for *systems* in Climate Zones 0 through 4 requiring dehumidification during heating mode that employ *series energy recovery* 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 6.5.6.1.2-1.
9. Indoor pool dehumidifiers meeting Section 6.5.6.4.

6.5.6.1.2.1 Minimum Enthalpy Recovery Ratio

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 above.

6.5.6.1.2.2 Provision for Air Economizer or Bypass Operation

Provision shall be made for both *outdoor air* and exhaust air to bypass or control the *energy* recovery *system* to enable economizer operation as required by Section 6.5.1.1. The bypass or *control* shall meet the following criteria:

a. For *energy* recovery *systems* where the transfer of *energy* cannot be stopped, bypass provision shall prevent the total airflow rates of both *outdoor air* and exhaust air through the energy recovery system from exceeding 10% of the full design airflow rate.
b. The pressure drop of the outdoor air through the energy recovery system shall not exceed 0.4 in. H_2O (100 Pa); the pressure drop of the exhaust air through the energy recovery system shall not exceed 0.3 in. H_2O (75 Pa).

Exceptions to 6.5.6.1.2.2

1. Energy recovery *systems* with 80% or more *outdoor air* at full design airflow rate and not exceeding 10,000 CFM (4.72 m^3/s).

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)