

EC126-09/10 Part I & Part II

EECC Requested Final Action: Approved as Modified by the Public Comment

EECC Reason Statement:

EC126 should be approved as modified by this public comment.

Among the individual (non-package) proposals being considered, this proposal, if approved as modified, is a big energy saver – from either improved thermal distribution systems or tested air leakage improvements with energy recovery equipment.

The modifications in this public comment will specifically require ducts and air handlers in conditioned space (as DOE’s original EC13 does). As an Exception (alternative), other more efficient distribution systems, like hydronic and ductless (already included and defined in the code), will be permitted. And for those who do not want to redesign and construct improved distribution/duct systems, there will be the option to install either an ERV or HRV energy recovery ventilation system.

The effect of these modifications will also be to create more consistency with EC13, while avoiding any federal preemption claims related to improved mechanical equipment. This proposal also removes the term specific leakage area and uses air changes per hour (ACH) for the air leakage requirements, as in EC13. To address the comment from the IECC committee, the modification alters the exceptions to remove potentially confusing language.

The resulting efficiency (and cost savings) are significant:

(1) With the baseline requirement of ducts in the conditioned space, most of the heating and cooling energy will make it to the conditioned space, with a default distribution efficiency of 88%.

(2) With ductless thermal distribution systems, there are no distribution system losses through ducts, with a default distribution efficiency of 100%.

(3) With hydronic thermal distribution systems, there are minimal distribution system losses, with a default distribution efficiency of 95% when the system is located in unconditioned space and 100% when it is within conditioned space.

(4) With the energy recovery equipment, this proposal achieves approximately 5 to 12% purchased energy savings (including heating, cooling, hot water, appliance and lighting energy use) depending on specific house and location. This translates to energy savings that range from \$100 to \$300 per year.

Each of these four options will save significant energy compared to the current baseline in the 2009 IECC and IRC.

EECC Proposed Modification to Original Proposal:

Part I - IECC

SECTION 202 GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such

systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

~~**403.11 Energy recovery ventilation system and air leakage supplemental requirements Thermal distribution system efficiency.** The building shall meet the following requirements: The entire thermal distribution system, including all ducts and air handlers, shall be located entirely within the conditioned space.~~

Exception: Buildings that meet all of the requirements in one of the following three exceptions:

1. An energy recovery ventilation system, that includes either an energy recovery ventilator or heat recovery ventilator, shall be installed. For warm humid counties as identified in table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the energy recovery ventilation system. ~~2. Building air leakage shall be tested in accordance with the procedure prescribed in Section 402.4.1.2.1, except that the~~ The air leakage shall not exceed three air changes per hour (ACH50) 0.00015 specific leakage area (SLA) for all buildings except multifamily, which shall not exceed four air changes per hour (ACH50) 0.00018 specific leakage area (SLA), when tested with a blower door at a pressure of 33.5 psf 0.2 inches w.g. (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.

2. A hydronic thermal distribution system, as defined in the notes to Table 405.5.2(2), shall be installed for space heating and cooling systems.

3. A ductless thermal distribution system, as defined in the notes to Table 405.5.2(2), shall be installed for space heating and cooling systems.

Exceptions:

~~1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.~~

~~2. Buildings located in climate zones 3 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.~~

~~3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.~~

~~4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when approved by the code official,~~

~~5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.~~

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	<p><i>Specific leakage area (SLA) = 0.00015 with a 70% efficient energy recovery ventilation system.</i></p> <p><u>Air leakage rate of 5 air changes per hour in zones 1 through 8 at a pressure of 0.2 inches w.g., (50 Pa).</u></p> <p><u>The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where:</u></p> <p><u><i>CFA</i> = conditioned floor area</u> <u><i>N_{br}</i> = number of bedrooms</u></p> <p><u>Energy recovery shall not be assumed for mechanical ventilation.</u></p> <p>Exceptions: 1. For multifamily buildings, the <u>specific air leakage area shall be 7 ACH50 assuming no energy recovery when tested with a blower door at a pressure of 0.2 inches w.g. (50 Pa) 0.00018 with a 70% efficient energy recovery ventilation system.</u> 2. For buildings subject to the exceptions in section 403.11, <u>SLA = 0.00030, assuming no energy recovery.</u></p>	<p><u>The measured air exchange rate as determined through testing in accordance with section 402.4.1.2.</u></p> <p><u>The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed.</u></p> <p><i>Specific Leakage Area (SLA) = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be:</i></p> <p>1. For residences without mechanical ventilation the measured air exchange rate^e but not less than 0.35 ACH.</p> <p>2. For residences with mechanical ventilation that is not an <i>energy recovery ventilation system</i> the measured air exchange rate^e combined with the mechanical ventilation rate, <i>f</i> which shall not be less than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: <i>CFA</i> = conditioned floor area <i>N_{br}</i> = number of bedrooms</p> <p>3. For residences with <i>energy recovery ventilation systems</i>, the efficiency of the energy or heat recovery ventilation system shall be as proposed.</p>
Thermal distribution systems	<p>A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.</p> <p>Duct insulation: from Section 403.2.1</p> <p><i>For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.</i></p>	<p>As tested or as specified in Table 405.5.2 (2) if not tested <u>The air leakage rate or DSE shall be as tested in accordance with Section 403.2.2.</u></p> <p><u>Duct insulation shall be as proposed.</u></p> <p><u>Exception: Proposed distribution systems that qualify for default values under Table 405.5.2 may use the DSE specified in Table 405.5.2(2) in lieu of tested air leakage values. Forced air systems located entirely in conditioned space, may use the default value only when ducts are also tested and meet the maximum value set forth in the Exception to 403.2.2. and are insulated as required in Section 403.2.1.</u></p>

d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

$$SLA = L/CFA$$

where L and CFA are in the same units.

Part II - IRC

SECTION R202 GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

~~**N1103.10 Energy recovery ventilation system and air leakage supplemental requirements Thermal distribution system efficiency.** The building shall meet the following requirements: The entire thermal distribution system, including all ducts and air handlers, shall be located entirely within the conditioned space.~~

Exception: Buildings that meet all of the requirements in one of the following three exceptions:

1. An energy recovery ventilation system, that includes either an energy recovery ventilator or heat recovery ventilator, shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built in humidistat shall be installed in addition to the energy recovery ventilation system. ~~2. Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.1.2.1, except that the~~ The air leakage shall not exceed three air changes per hour (ACH50) 0.00015 specific leakage area (SLA) for all buildings except multifamily, which shall not exceed four air changes per hour (ACH50) 0.00018 specific leakage area (SLA), when tested with a blower door at a pressure of 33.5 psf 0.2 inches w.g. (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.

2. A hydronic thermal distribution system, as defined in the notes to Table 405.5.2(2) of the IECC, shall be installed for space heating and cooling systems.

3. A ductless thermal distribution system, as defined in the notes to Table 405.5.2(2) of the IECC, shall be installed for space heating and cooling systems.

Exceptions:

~~1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent and meets or exceeds 12.5 EER.~~

~~2. Buildings located in climate zones 3 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15 percent and cooling equipment that meets or exceeds 12.5 EER.~~

~~3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent.~~

~~4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *building official*,~~

~~5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.~~

Proposal History:

Committee Recommended Action on Original Proposal at Public Hearing:

Part I IECC – Disapproved

Part II IRC – Disapproved

Committee Reason(s) for Recommended Action:

Part I IECC – The proposal would provide a conflict with EC13. The energy recovery ventilator would not be cost effective in cold climates.

Part II IRC – The structure of the code would be confusing, given that there are exceptions to other exceptions. The reference to specific leakage area is confusing, as it is not an accepted term in the IECC vernacular.

Initial Recommendation of EECC: Approve

Initial Proposal for Reference:

EC126–09/10

202 (New), 403.11 (New), Table 405.5.2(1); IRC R202 (New), N1103.10 (New)

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise definition as follows:

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

2. Add new definition as follows:

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

3. Add new text as follows:

403.11 Energy recovery ventilation system and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An energy recovery ventilation system shall be installed. For warm humid counties as identified in Table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the energy recovery ventilation system.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section 402.4.2.1, except that the air leakage shall not exceed 0.00015 specific leakage area (SLA) for all buildings except multifamily, which shall not exceed 0.00018 specific leakage area (SLA), when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.

Exceptions:

1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when approved by the code official.
5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

4. Revise table as follows:

**TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	<p><i>Specific leakage area (SLA)^e = 0.0001536 assuming no energy recovery, with a 70% efficient energy recovery ventilation system.</i></p> <p><u>Exceptions:</u></p> <ol style="list-style-type: none"> 1. <u>For multifamily buildings, the specific leakage area shall be 0.00018 with a 70% efficient energy recovery ventilation system.</u> 2. <u>For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery.</u> 	<p>For residences that are not tested, the same as the standard reference design.</p> <p><u>Specific Leakage Area (SLA) = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be:</u></p> <ol style="list-style-type: none"> 1. <u>For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate^e but not less than 0.35 ACH.</u> 2. <u>For residences with mechanical ventilation that is not an energy recovery ventilation system that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate^e combined with the mechanical ventilation rate, <i>f</i> which shall not be less than $0.01 \times CFA + 7.5 \times (N_{br} + 1)$ where: CFA = conditioned floor area <i>N_{br}</i> = number of bedrooms</u> 3. <u>For residences with energy recovery ventilation systems, the efficiency of the energy or heat recovery ventilation system shall be as proposed.</u>

d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

SLA = L/CFA
where L and CFA are in the same units.

(Portions of table and footnotes not shown remain unchanged)

PART II – IRC BUILDING/ENERGY

1. Add new definitions as follows:

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

2. Add new text as follows:

N1103.10 Energy recovery ventilation system and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An energy recovery ventilation system shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built in humidistat shall be installed in addition to the energy recovery ventilation system.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.2.1, except that the air leakage shall not exceed 0.00015 specific leakage area (SLA) for all buildings except multifamily, which shall not exceed 0.00018 specific leakage area (SLA), when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.

Exceptions:

1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent and meets or exceeds 12.5 EER.
2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15 percent and cooling equipment that meets or exceeds 12.5 EER.
3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent.
4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when approved by the building official.
5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

Reason: There is significant energy savings potential in homes through tested air leakage improvements with energy recovery ventilation equipment or though having higher efficiency equipment. This proposal creates a trade-up opportunity, where a home can achieve significant savings through either the primary requirements or the exceptions. This proposal also makes necessary changes to Table 405.4.2(1) of the IECC to incorporate the effects of this proposal into the Simulated Performance Alternative in Section 405.

For the primary requirements, this proposal achieves significant savings from tested air leakage improvements with energy recovery equipment. These base requirements achieve approximately 12-17% estimated heating and cooling energy savings or approximately 5 to 12% purchased energy savings (including appliances and lighting) depending on the location and home specifications.

One of the key criteria in the primary requirements is to install an energy recovery ventilation system (either ERV or HRV). This is critical for achieving energy savings from a tight home. Without the energy recovery ventilation system, no home or program can claim energy savings credit for substantially tight homes. Therefore, by tightening the house to levels that many houses today are already tightening them (0.00015), minimal to no savings are achieved depending on the location. However, by installing the energy recovery ventilator energy savings between \$100-300 per year are achieved depending on the climate. The most savings are achieved in the coldest climates due to the extreme temperature difference between the inside and outside temperatures.

The exception has reasonable and sensible equipment requirements that can achieve approximately 10-16% heating and cooling energy savings or approximately 5-11% purchased energy savings depending on location and home specifications. Example specifications for the exemption include:

- >15.6 SEER and 12.5 EER AC in Climate Zone 1 & 2
with available equipment up to 23 SEER
includes 46,375 records from AHRI directory of air conditioning equipment available
- >14.95 SEER and 12.5 EER AC in Climate Zone 3, 4 and 5
with available equipment up to 23 SEER
includes 101,899 records from AHRI directory of air conditioning equipment available
- > 89.7 AFUE in Climate Zone 3, 4 and 5
with available equipment up to 96+ AFUE
includes 5,100 records from AHRI directory of furnace equipment available
- > 93.6 AFUE in Climate Zone 6, 7 and 8
with available equipment up to 96+ AFUE
includes 1,339 records from AHRI directory of furnace equipment available
- > 8.86 HSPF in Climate Zone 3, 4 and 5
with available equipment up to 11 HSPF
includes 27,310 records from AHRI directory of heat pump equipment available
- > 9.24 HSPF in Climate Zone 6, 7 and 8
with available equipment up to 11 HSPF
includes 9,051 records from AHRI directory of heat pump equipment available

In addition to having the improved efficiency requirement beyond federal minimum standards, this proposal also has improved EER rating in the exception that will ensure higher performance in peak temperature hours. Per ACEEE, for utilities, reducing peak demand is worth somewhere in the range of \$1000/kW. That is an estimate of the costs avoided by not building new peak generation, plus the required reinforcements of transmission and distribution. In many cases, capacity constraints for the foreseeable future make avoiding peak demand even more valuable than saving energy. For a 3-ton central air conditioner the difference between EER 11.5 and EER 12 is about 0.13 kW on a 95°F day. This difference is much of the justification for rebates in CA, for example, since by itself a 0.13 kW peak reduction is worth roughly \$130. (source: ACEEE)

The exception that allows for ground source heat pumps (GSHP) with efficiency greater than or equal to 2.8 COP to be installed in climates 3 through 8, is based on DOE recommendations, while FEMP recommends GSHP efficiency levels of 3.3 COP of higher. It is also important to point out that maximum efficiency for GSHP are closer to 5 COP.

Source: http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12670
Source: http://www1.eere.energy.gov/femp/procurement/eep_groundsource_heatpumps.html

Cost Impact: The code change proposal will increase the cost of construction.

PART I – IECC

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II – IRC BUILDING/ENERGY

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: PRINDLE-EC-27-202-403.11-R202-N1103.10