2013 PROPOSED CHANGES TO THE INTERNATIONAL ENERGY CONSERVATION CODE- COMMERCIAL PROVISIONS

INTERNATIONAL COMMERCIAL ENERGY CONSERVATION CODE - COMMERCIAL COMMITTEE

Robert S. Austin - Chair
Code Specialist
NJ Department of Community Affairs
Division of Codes and Standards
Trenton, NJ

Shahriar Amiri – Vice Chair
Building Official
Arlington County, Virginia
Arlington, VA

Chuck Anderson, PE
Regulatory Affairs Manager
Guardian Industries
Mineral Wells, WV

Joseph F. Andre
National Electrical Manufacturers Assoc.
Bothel, WA

James R. Burton
Manager/Compliance Services
T.Y. Lin Engineering
Rochester, NY

Laura Dwyer
Rep: National Association of Home Builders
DuPont Building Knowledge Manager
DuPont Building Innovations
Wilmington, DE

Rhonda Harding-Hill
Energy Program Manager – Building Codes
Oklahoma State Energy Office
Oklahoma City, OK

M. Dwayne Hicks, MCP
Chief Building/Fire Code Official
City of Mount Juliet
Mt. Juliet, TN

Ron Nickson
VP of Building Codes
National Multi Housing Council
Washington, DC

Gil Rossmiller
Chief Building Official
Town of Parker, Colorado
Parker, CO

Ann L. Stanton
Building Codes Analyst
Florida Department of Business & Professional Regulation
Tallahassee, FL

Adrienne Thomle
Senior Product Manager
Honeywell International
Golden Valley, MN

James Trout
Associate Wx Director
CAASTLC, Inc
St. Louis, MO

Mike Winkler
Building Official
Holland Charter Township
Holland, MI

Staff Secretariat:
Kermit Robinson
Senior Technical Staff
International Code Council
Los Angeles District Office
5360 Workman Mill Road
Whittier, CA 90601
Tel: 888/422-7233 ext: 3317
Fax: 562/699-4522

TENTATIVE ORDER OF DISCUSSION
2013 PROPOSED CHANGES TO THE
INTERNATIONAL ENERGY CONSERVATION CODE – COMMERCIAL

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair. Please consult the Cross Index of Proposed Changes.

- CE1-13 Part I
  - ADM1-13 Part II
- CE2-13 Part I
- CE3-13 Part I
  - ADM51-13 Part II
  - ADM52-13 Part II
  - ADM60-13 Part II
- CE4-13 Part I
- CE5-13
- CE6-13 Part I
- CE7-13 Part I
- CE8-13 Part I
- CE9-13 Part I
- CE10-13 Part I
- CE11-13 Part I
- CE12-13
- CE13-13
- CE14-13
- CE15-13 Part I
  - CE56-13
- CE16-13 Part I
- CE17-13
- CE18-13
- CE19-13 Part I
- CE20-13 Part I
- CE21-13
- CE22-13 Part I
- CE23-13 Part I
- CE24-13
- CE25-13
- CE26-13
- CE27-13
- CE28-13 Part I
- CE29-13 Part I
- CE30-13 Part I
- CE31-13 Part I
- CE32-13 Part I
- CE33-13 Part I
- CE34-13 Part I
  - ADM40-13 Part II
  - ADM41-13 Part II
- CE35-13 Part I
- CE36-13
- CE37-13 Part I
  - CE47-13 Part I
  - CE48-13 Part I
- CE38-13-13 Part I
  - ADM30-13 Part II
- CE39-13 Part I
- CE40-13 Part I
- CE41-13 Part I
  - ADM57-13 Part II
- CE42-13
- CE43-13 Part I
  - ADM47-13 Part II
  - ADM22-13 Part II
- CE44-13 Part I
  - ADM53-13 Part II
  - ADM55-13 Part II
- CE51-13 Part I
- CE60-13
- CE61-13 Part I
- CE62-13 Part I
  - CE66-13 Part I
  - CE50-13 Part I
- CE63-13 Part I
- CE64-13 Part I
- CE65-13 Part I
- CE67-13 Part I
- CE68-13 Part I
- CE69-13
- CE70-13
- CE71-13
- CE72-13
- CE73-13
- CE74-13
- CE75-13
- CE76-13
- CE77-13
- CE78-13
- CE79-13
- CE80-13
- CE81-13
- CE82-13
- CE83-13
- CE84-13 Part I
- CE85-13
- CE86-13
- CE87-13
- CE88-13
- CE89-13
- CE90-13
  - CE54-13
- CE91-13
- CE92-13
- CE93-13
- CE94-13
- CE95-13
- CE96-13
- CE97-13
- CE98-13
- CE99-13
- CE100-13
- CE101-13
- CE102-13
- CE103-13
- CE104-13
- CE105-13
- CE106-13
- CE107-13
- CE108-13
- CE109-13
- CE110-13
- CE111-13
- CE112-13
- CE113-13
- CE114-13
- CE115-13
- CE116-13
- CE117-13
- CE118-13
- CE119-13
- CE120-13
- CE121-13
- CE122-13
- CE123-13
- CE124-13
- CE125-13
  - CE45-13
- CE126-13
- CE127-13 Part I
- CE128-13
- CE129-13
- CE130-13
  - CE52-13 Part I
- CE131-13
- CE132-13
- CE133-13
- CE134-13
- CE135-13
- CE136-13
- CE137-13
- CE138-13
- CE139-13
- CE140-13
  - CE58-13 Part I
  - CE59-13 Part I
- CE141-13
- CE142-13
- CE143-13
- CE144-13
- CE145-13
- CE146-13
- CE147-13
- CE148-13
- CE149-13
- CE150-13
- CE151-13
  - CE57-13
- CE152-13
- CE153-13
- CE154-13
- CE155-13
- CE156-13
- CE157-13
- CE158-13
- CE159-13
- CE160-13 Part I
- CE161-13 Part I
- CE162-13
- CE163-13
  - CE46-13 Part I
  - CE53-13
- CE164-13
- CE165-13
- CE166-13
- CE167-13
- CE168-13
- CE169-13
- CE170-13
- CE171-13
- CE172-13
- CE173-13
- CE174-13

CE175-13
CE176-13
CE177-13 Part I
CE178-13
CE179-13 Part I
CE180-13
CE181-13
CE182-13
CE183-13
CE184-13
CE185-13
CE186-13
CE187-13
CE188-13
CE189-13
CE190-13
CE191-13
CE192-13
CE193-13
CE194-13
CE195-13
CE196-13
CE197-13
CE198-13
CE199-13
CE200-13
CE201-13
CE202-13
CE203-13
CE204-13
CE205-13
CE206-13
CE207-13
CE208-13
CE209-13
CE210-13
CE211-13
CE212-13
CE213-13
CE214-13
CE215-13
CE216-13
CE217-13
CE218-13
CE219-13
CE220-13
CE221-13
CE222-13
CE223-13
CE224-13
CE225-13
CE226-13
CE227-13
CE228-13
CE229-13
CE230-13 Part I
CE231-13
CE232-13
CE233-13
CE234-13
CE55-13

CE235-13
CE236-13
CE237-13
CE238-13
CE239-13
CE240-13
CE241-13
CE242-13
CE243-13
CE244-13
CE245-13
CE246-13
CE247-13
CE248-13
CE249-13
CE250-13
CE251-13
CE252-13
CE253-13
CE254-13
CE255-13
CE256-13
CE257-13
CE258-13
CE259-13
CE260-13
CE261-13
CE262-13
CE263-13
CE264-13
CE265-13
CE266-13
CE267-13
CE268-13
CE269-13
CE49-13, Part I
CE49-13, Part II
CE270-13, Part I
CE270-13, Part II
CE271-13, Part I
CE271-13, Part II
CE272-13, Part I
CE272-13, Part II
CE273-13, Part I
CE273-13, Part II
CE274-13
CE275-13
CE276-13
CE277-13
CE278-13, Part I
CE278-13, Part II
CE279-13, Part I
CE279-13, Part II
CE280-13, Part I
CE280-13, Part II
CE281-13
SP19-13, Part II
CE282-13, Part I
CE282-13, Part II
CE283-13 Part I
CE284-13

CE285-13 Part I
CE286-13
CE287-13
CE288-13
CE289-13
CE290-13
CE291-13
CE292-13
CE293-13
CE294-13
CE295-13
CE296-13
CE297-13
CE298-13
CE299-13
CE300-13
CE301-13
CE302-13
CE303-13
CE304-13
CE305-13
CE306-13
CE307-13
CE308-13
CE309-13
CE310-13
CE311-13
CE312-13
CE313-13
CE314-13
CE315-13
CE316-13
CE317-13
CE318-13
CE319-13
CE320-13
CE321-13
CE322-13
CE323-13
CE324-13
CE325-13
CE326-13
CE327-13
CE328-13
CE329-13
CE330-13
CE331-13
CE332-13
CE333-13
CE334-13
CE335-13
CE336-13
CE337-13
CE338-13
CE339-13
CE340-13
CE341-13
CE342-13
CE343-13
CE344-13
CE345-13

CE346-13
CE347-13
CE348-13
CE349-13
PC2-13
PC3-13
CE350-13
CE351-13
CE352-13
CE353-13
CE354-13
CE355-13
CE356-13
CE357-13
CE358 -13
CE359-13
CE360-13
CE361-13

CE1 – 13

C101.2, C101.3, C101.3.1 (NEW), C101.3.2 (NEW), C101.4.2, C101.4.3, C101.4.6 (NEW), C101.4.6.1, C101.4.6.2, C101.4.6.3, C101.5, C102, C102.1, C102.1.1, R101.2, R101.3 (IRC N11101.2), R101.3.1 (NEW) (IRC N1101.2.1 (NEW)), R101.3.2 (NEW) (IRC N1101.2.2 (NEW)), R101.4.2, R101.4.3 (IRC N1101.3), R101.4.6 (NEW), R101.4.6.1, R101.4.6.2, R101.4.6.3 (NEW), R101.5 (IRC N1101.5 (NEW)), R102, R102.1, R102.1.1 (IRC N1101.7)

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.2 Scope. This code applies to *commercial buildings* <u>and *residential buildings*</u>, ~~and~~ the building sites and associated systems and equipment. <u>*Commercial buildings* shall meet the requirements of the commercial provisions of this code, designated with a prefix "C". *Residential buildings* shall meet the requirements of the residential provisions of this code, designated with a prefix "R". Provisions without a designation “C” or “R” apply to all buildings.</u>

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. ~~This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.~~ This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

<u>**C101.3.1 Alternate materials, systems, approaches or techniques.** This code is intended to provide flexibility to permit the use of innovative materials, systems, approaches or techniques to achieve this objective, provided such alternate proposals are *approved* by the *code official*.</u>

<u>**C101.3.2 Above-code programs.** The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as «mandatory» in Chapters C4 and R4 shall be met.</u>

~~**C101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

~~**C101.4.3**~~ <u>**C101.4.2**</u> **Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. ~~Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems.~~ An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space less than 5000 square feet, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the ~~bulb~~ lamp and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

~~C101.4.4~~ C101.4.3 Change in occupancy or use. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.

~~C101.4.5~~ C101.4.4 Change in space conditioning. Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

~~C101.4.6~~ C101.4.5 Mixed occupancy. Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.

C101.4.6 Exempt buildings or work. The following buildings or portions thereof shall be exempt from this code:

C101.4.6.1 Historic buildings. Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, is exempt from this code.

C101.4.6.2 Certain additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs, to the extent that compliance with this code would create an unsafe or hazardous condition or overload existing building systems, and for which there is not a feasible compliant alternative, shall be exempt from this code.

C101.4.6.3 Envelope assemblies of low-energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code, shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4. Btu/h /ft^2 (10.7 W/m^2) or 1.0 watt/ft2 (10.7 W/m^2) of floor area for space conditioning purposes.

2. Those that do not contain *conditioned space*.

~~**C101.5 Compliance.** Residential buildings shall meet the provisions of IECC-Residential Provisions. Commercial buildings shall meet the provisions of IECC-Commercial Provisions~~.

C101.5 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

~~**C101.5.1 Compliance materials.** The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code~~.

~~**SECTION C102**~~
~~**ALTERNATE MATERIALS – METHOD OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS**~~

~~**C102.1 General.** This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the intent of this code.~~

~~**C102.1.1 Above code programs.** The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as "mandatory" in Chapter 4 shall be met.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.2 Scope. This code applies to *residential buildings* and *commercial buildings* the buildings sites and associated systems and equipment. *Commercial buildings* shall meet the requirements of the commercial provisions of this code, designated with a prefix "C". *Residential buildings* shall meet the requirements of the residential provisions of this code, designated with a prefix "R". Provisions without a designation "C" or "R" apply to all buildings.

R101.3 (N1101.2) Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. ~~This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.~~ This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

R101.3.1 (N1101.2.1) Alternate materials, systems, approaches or techniques. This code is intended to provide flexibility to permit the use of innovative materials, systems, approaches or techniques to achieve this objective, provided such alternate proposals are *approved* by the *code official*.

R101.3.2 (N1101.2.2) Above-code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as «mandatory» in Chapters C4 and R4 shall be met.

~~**R101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

~~R101.4.3 (N1101.3)~~ <u>R101.4.2</u> **Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. ~~Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems.~~ An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space <u>less than 5000 square feet</u>, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the ~~bulb~~ <u>lamp</u> and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

~~R101.4.4~~ <u>R101.4.3</u> **Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.

~~R101.4.5 (N1101.4)~~ <u>R101.4.4</u> **Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

~~R101.4.6~~ <u>R101.4.5</u> **Mixed occupancy.** Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.

<u>**R101.4.6 Exempt buildings or work.** The following buildings or portions thereof shall be exempt from this code:</u>

<u>**R101.4.6.1 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, is exempt from this code.</u>

<u>**R101.4.6.2 Certain additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs, to the extent that compliance with this code would create an unsafe or hazardous condition or overload existing building systems, and for which there is not a feasible compliant alternative, shall be exempt from this code.</u>

R101.4.6.3 Envelope assemblies of low-energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code, shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4. Btu/h /ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

~~**R101.5 Compliance.** Residential buildings shall meet the provisions of IECC-Residential Provisions. Commercial buildings shall meet the provisions of IECC-Commercial Provisions~~.

R101.5 (N1101.5) Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

~~**R101.5.1 (N1101.5) Compliance materials.** The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code~~.

~~**SECTION R102**~~
~~**ALTERNATE MATERIALS – METHOD OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS**~~

~~**R102.1 General.** This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the intent of this code.~~

~~**R102.1.1 (N1101.7) Above code programs.** The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as "mandatory" in Chapter 4 shall be met.~~

Reason: This proposed change reorganizes Section 101 to provide greater clarity regarding intent and flexibility, applicability and exemptions, and compliance materials, all as part of the Scope and General Requirements section. This will help both the code official and the registered design professional to understand how these important concepts apply.

Cost Impact: The code change proposal will not increase the cost of construction. It clarifies a framework for the energy code and does not affect either design or construction.

CE1-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.2-EC-TAYLOR.doc

CE2 – 13
C101.3, R101.3 (N1101.2)

Proponent: William W Stewart, FAIA, PE, representing self (codedoc@sbcglobal.net)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the ~~effective~~ use and conservation of energy over the ~~useful~~ life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.3 (N1101.2) Intent. This code shall regulate the design and construction of buildings for the ~~effective~~ use and conservation of energy over the ~~useful~~ life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: The deleted words are subjective and add nothing to the code. The "effective" use of energy is neither definable or enforceable. What is effective to some is not effective to others. No where in the code is the "useful" life of a building defined and it depends of the needs of the occupant. Is a building designed with cutting edge technology no longer useful when a higher level if technology is applied to newer buildings? Additionally, a remodeled building could have a longer "useful" life than anticipated by the original owner. As revised, the code would be understandable and enforceable.

Cost Impact: The code change will not increase the cost of construction.

CE2-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.3-CE-STEWART.doc

CE3 – 13
C101.4.3, R101.4.3 (IRC N1101.3), IEBC 707.1, 811.1

Proponent: Randall R. Dahmen, P.E., Licensed Wisconsin Commercial Building Inspector, representing self

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE, PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART III WILL BE HEARD BY THE EXISTING BUILDING CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C101.4.3 Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Glass only replacements in an existing sash and frame.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
6. ~~Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,~~
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
8. ~~Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

~~**R101.4.3 (N1101.4.3) Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Glass only replacements in an existing sash and frame.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
6. ~~Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,~~
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
8. ~~Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

PART III – IEBC

Delete and substitute as follows:

~~**707.1 Minimum requirements.** Level 1 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *International Energy Conservation Code* or *International Residential Code.* The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.~~

707.1 Minimum requirements. Alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of the *International Energy Conservation Code* as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, An existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, where such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space where the *alteration* does not increase the installed interior lighting power.

Delete and substitute as follows:

~~**811.1 Minimum requirements.** Level 2 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the~~

~~*International Energy Conservation Code* or *International Residential Code.* The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.~~

811.1 Minimum requirements. A building, building system, or portion thereof that is altered shall comply with Section 707.

Reason: The requirements referenced in this code section are issues that deal with existing buildings. As such, the requirements should be listed in the IEBC. If it is felt that the requirements need to remain as part of the IECC, then it is requested that the requirements be listed/referenced under both the IECC as well as the IEBC, as is commonly done throughout the ICC suite of codes. Having the same language in multiple ICC codes is commonly done throughout the ICC suites for issues such as fire dampers, etc. For example, review IBC 717.5 and IMC 607.5

Cost Impact: The code change proposal will not increase the cost of construction.

CE3-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

PART III – IEBC

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

C101.4.3-EC-DAHMEN.doc

CE4 – 13

C101.4.1 through C101.4.5, C202, C401.2.1, Chapter 5 (CE) (NEW), R101.4, R202 (IRC N1101.9); R402.3.6 (IRC N1102.3.6), Chapter 5 (RE) (NEW) (IRC N1106 (NEW))

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC – COMMERICAL PROVISIONS

Delete without substitution as follows:

~~**C101.4.1 Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.~~

~~**C101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

~~**C101.4.3 Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Glass only replacements in an existing sash and frame.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
6. ~~Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,~~
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
8. ~~Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

~~**C101.4.4 Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use~~

~~in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.~~

~~**C101.4.5 Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

Delete without substitution as follows:

~~**C401.2.1 Application to existing buildings.** Additions, alterations and repairs to existing buildings shall comply with one of the following:~~

1. ~~Sections C402, C403, C404 and C405; or~~
2. ~~ANSI/ASHRAE/IESNA 90.1.~~

Add new text as follows:

CHAPTER 5 CE EXISTING BUILDINGS

SECTION C501 GENERAL

C501.1 Scope. The provisions of this chapter shall control the *alteration*, *repair*, *addition* and change of occupancy of existing buildings and structures.

C501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

C501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or and systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

C501.4 Compliance. *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in the *International Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code* and NFPA 70.

C501.5 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

C501.6 Historic buildings. *Historic buildings* are exempt from this code.

SECTION C502 ADDITIONS

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

SECTION C503
ALTERATIONS

C503.1 General Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

C503.2 Change in space conditioning. Any nonconditioned or low energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

SECTION C504
REPAIRS

C504.1 General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1. repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

C504.2 Application. For the purposes of this code, the following shall be considered repairs.

1. Glass only replacements in an existing sash and frame.
2. Roof repairs where neither the sheathing nor the insulation is exposed~~.~~
3. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided however that an existing vestibule that separates a conditioned space from the exterior shall not be removed.
4. Repairs where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

SECTION C505
CHANGE OF OCCUPANCY OR USE

C505.1 General. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or C405.5.2 (2) to another use in Table C405.5.2(1) or C405.5.2 (2), the installed lighting wattage shall comply with Section C405.5.

Add new definitions as follows:

HISTORIC BUILDINGS. Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

PART II – IECC – RESIDENTIAL PROVISIONS

Revise as follows:

R101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

~~**R101.4.1 Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.~~

~~**R101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

~~**R101.4.3 (N1101.3) Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Glass only replacements in an existing sash and frame.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~

6. ~~Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,~~
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
8. ~~Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

~~**R101.4.4 Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.~~

~~**R101.4.5 (N1101.4) Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

~~R101.4.6~~ <u>R101.4.1</u> Mixed occupancy. Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of the IECC—Commercial and Residential Provisions.

Delete without substitution as follows:

~~**R402.3.6 (N1102.3.6) Replacement fenestration .** Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC in Table R402.1.1.~~

Add new text as follows:

<u>**CHAPTER 5 (RE)**</u>
<u>**EXISTING BUILDINGS**</u>

<u>**SECTION R501 (N1106)**</u>
<u>**GENERAL**</u>

<u>**R501.1 (N1106.1) Scope.** The provisions of this chapter shall control the *alteration*, *repair*, *addition* and change of occupancy of existing buildings and structures.</u>

<u>**R501.2 (N1106.2) Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.</u>

<u>**R501.3 (N1106.3) Maintenance.** Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or and systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.</u>

<u>**R501.4 (N1106.4) Compliance.** *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in the *International Residential Code, International Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code* and NFPA 70.</u>

<u>**R501.5 (N1106.5) New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided no hazard to life, health or property is created. Hazardous materials</u>

shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

R501.6 (N1106.6) Historic buildings. *Historic buildings* are exempt from this code.

SECTION R502 (N1107) ADDITIONS

R502.1 (N1107.1) General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

SECTION R503 (N1108) ALTERATIONS

R503.1 (N1108.1) Alterations. *Alterations* to any building or structure shall comply with the requirements of the code for new construction. *Alterations* shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the *alteration*. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

R503.2 (N1108.2) Change in space conditioning. Any nonconditioned or low energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

R503.3. (N1108.3) Replacement fenestration . Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC in Table R402.1.1.

SECTION R504 (N1109) REPAIRS

R504.1 (N1109.1) General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

R504.2 (N1109.2) Application. For the purposes of this code, the following shall be considered repairs.

1. Glass only replacements in an existing sash and frame.

2. Roof repairs where neither the sheathing nor the insulation is exposed.
3. Repairs where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

SECTION R505 (N1110)
CHANGE OF OCCUPANCY OR USE

R505.1 (N1110.1) General. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.

Add new definitions as follows:

HISTORIC BUILDINGS. Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

Reason: (PART I) This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The primary purpose of this proposal is to move the regulation of existing buildings under the IECC out of Chapter 1 and into its own Chapter. Chapter 1 should be reserved for administrative provisions of the code and not the technical standards applicable to renovating or expanding existing buildings. For the Commercial IECC there are additional provisions for existing buildings found in Section C401.2.1. Therefore the primary purpose is editorial. But the purpose is also forward looking. The vast majority of our building stock is existing. If more energy savings is to be found, a significant route is the upgrade of existing buildings. This change anticipates a growth in detail of such provisions, and the SEHPCAC fells that having a distinct existing buildings chapter will better accommodate the growth of such standards.

The committee used the general format of Chapter 34 of the IBC. It compared existing language in the IBC with that in the IECC and either chose language from one code or the other, or occasionally melded the two codes. The following table lists for each new section the source of the text.

Proposed Chapter Sections	Source code and Section
C501.1 Scope	IBC 3401.1
C501.2 Existing Buildings	IECC C101.4.1
C501.3 Maintenance	IBC 3401.2
C501.4 Compliance	IBC 3401.3
C501.5 New and replacement materials	IBC 3401.4
C501.6 Historic buildings	IECC C101.4.2
C502, Additions C502.1 General	IECC C101.4.3
C502.1 – General exception	IECC C401.2.1
C503 Alterations C503.1 General	IBC 3404.1 and IECC CC101.4.3
C503.2 Change in space conditioning	IECC 101.4.5
C504 Repairs C504.1 General	IBC 3405.1 IECC C101.4.3
C504.2 Application	IECC C101.4.3
C505 Change of Occupancy or Use C505.1 General	IECC C101.4.4

The proposal does simplify the language of the historic building section to a simple exemption, but at the same time proposes a definition Historic Buildings to be added to the IECC. Most of the current text of Section C101.4.2 is actually definition. The Committee noted that there is a difference between the definitions of historic buildings in the IBC versus the IEBC. It chose the IBC version, for consistency with the lead code. The IRC does not define historic buildings.

Another substantive change – or perhaps clarification is regarding a potential of a low energy space becoming a fully conditioned space. The current text of the IECC does not address such a conversion. This proposal treats such changes the same as that of creating a conditioned space from a non-conditioned space.

Section C101.4.3 includes a list of 8 actions which are exempt from compliance with the code. Since C101.4.3 addresses all three actions (additions, alterations and repairs) it is unclear where the 8 exceptions applies. The Committee reviewed each and felt that 4 belonged in the alteration section and 4 in the repairs section.

Finally the provisions currently found in Section 401.2.1 allowing the use of ASHRAE 90.1 is translated into an alternate compliance path. for additions in Section C502. The assumption is that the design of an addition can comply with the IECC or the ASHRAE 90.1 regardless of the requirements applied to the original building. For Alterations a similar exception is provided allowing use of either IECC or ASHRAE 90.1. These are simply shown as text allowing alternate compliance and not exception. The term exception implies a lesser standard; ASHRAE 90.1 should not be viewed as a lesser standard. However for repairs, the proposal only allows use of ASHRAE 90.1 for repairs if the original design was per ASHRAE 90.1.

(PART II): This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

See the Reason statement for Part I of this proposal.

When the IECC was divided into two parallel documents, the provisions for existing buildings were copied nearly word for word into both C104 and R104. Therefore the IECC residential proposal mirrors the IECC Commercial proposal with 3 distinct differences.

1. ASHRAE 90.1 is not address as the standard is not applicable to 'residential' buildings.
2. Section R402.3.6 on replacement fenestration is added as it only applies to residential.
3. What is Item 3 in Section C504.2 does not appear in the residential version. This Item addresses maintaining door vestibules and/or revolving doors where such doors separate conditioned from non-conditioned space. Vestibules are a requirement in the IECC Commercial new construction provisions – but are not found in the residential. Therefore requiring maintenance under the residential provisions is inappropriate.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is an editorial relocation of existing text. There will be no impact on the cost of construction.

EC4-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

CHAPTER 5 (NEW)-EC-THOMPSON-SEHPCAC

CE5 – 13
C202, C101.4.3, C409 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Delete and substitute as follows:

~~**C101.4.3 Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

1. ~~Storm windows installed over existing fenestration.~~
2. ~~Glass only replacements in an existing sash and frame.~~
3. ~~Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
6. ~~Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed.~~
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
8. ~~Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

C101.4.3 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Section C409.

Add new text as follows:

SECTION C409
ADDITIONS, ALTERATIONS, OR REPAIRS

C409.1 Scope. The provisions of this chapter shall control the *alteration*, *repair,* and *addition* of existing buildings and structures for compliance with the *International Energy Conservation Code*.

C409.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration,* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

C409.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and/or systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

C409.4 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system, or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building supply system to comply with this code. Additions, alterations, or repairs shall not create an unsafe or hazardous condition or overload existing building systems.

C409.4.1 Additions. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply as a single building. Additions shall comply with Section C409.4.1.1.

> **Exception:** Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.

C409.4.1.1 Prescriptive compliance. Additions shall comply with Sections C409.4.1.1.1 through C409.4.1.1.5.

C409.4.1.1.1 Building envelope. New building envelope assemblies that are part of the addition shall comply with Sections C402.1 through C402.4.

C409.4.1.1.1.1 Vertical Fenestration. New vertical fenestration area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C402.3.1.1 for the addition only. Additions that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407 or ASHRAE 90.1.

C409.4.1.1.1.2 Skylight area. New skylight area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with skylight area that result in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the addition only. Additions that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407 or ASHRAE 90.1.

C409.4.1.1.2 Building mechanical systems. New mechanical systems and equipment serving the building heating, cooling or ventilation needs, that are part of the addition, shall comply with Section C403.

C409.4.1.1.3 Service water heating systems. New service water-heating equipment, controls and service water heating piping shall comply with Section C404.

C409.4.1.1.4 Pools and inground permanently installed spas. New pools and inground permanently installed spas shall comply with Section C404.7.

C409.4.1.1.5 Electrical power and lighting systems. New lighting systems that are installed as part of the addition shall comply with Section C405.

C409.4.1.1.5.1 Interior lighting power. The total interior lighting power for the addition shall comply with Section C405.5.2 for the addition alone or if the existing building and the addition complies as a single building.

C409.4.1.1.5.2 Exterior lighting power. The total exterior lighting power for the addition shall comply with Section C405.6.2 for the addition alone or if the existing building and the addition complies as a single building.

C409.4.2 Alterations. Alterations to existing buildings shall comply with Section C409.4.2.1 through C409.4.2.4. *Alterations* shall be such that the existing building or structure is no less complying with the provisions of this code than the existing building or structure was prior to the *alteration*.

Exception: Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.

C409.4.2.1 Building envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.4.

C409.4.2.1.1 Vertical Fenestration. The addition of vertical fenestration that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. The addition of vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C405.2.2.3.2 for the space adjacent to the new fenestration only. Alterations that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407 or ASHRAE 90.1.

C409.4.2.1.2 Skylight area. The addition of skylight area that results in a total building skylight area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. The addition of skylight area that results in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the space adjacent to the new skylights. Alterations that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407 or ASHRAE 90.1.

Exceptions: The following building envelope alterations are exempt from Section C409.4.2.1.

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.

C409.4.2.2 Heating and cooling systems. New heating, cooling, and duct systems that are part of the alteration shall comply with Sections C403.

C409.4.2.2.1 Economizers. New cooling systems that are part of alteration shall comply with section C403.3.1 or C403.4.1.

C409.4.2.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section C404.

C409.4.2.4 Lighting. New lighting systems that are part of the alteration shall comply with Section C405.

Exceptions.

1. Alterations that replace less than 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
2. Alterations that replace on the bulb and ballast within the existing luminaires in a space provided that the alteration does not increase the installed interior lighting power.

C409.4.3 Repairs. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C409.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C409.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section. Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1. repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

Exceptions: The following alterations are exempt from Section C409.4.3.

1. Glass only replacements in an existing sash and frame this is a repair.
2. Reroofing for roofs where neither the sheathing nor the insulation is exposed this is a repair.

Revise definition as follows:

IECC SECTION C202
GENERAL DEFINITIONS

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

Reason: The commercial provisions of the 2012 IECC require that additions, alterations, renovations, or repairs comply with the provisions of the energy code without providing a clear "roadmap" on the specific requirements that apply to these projects. The goal of this code change proposal is to provide clear direction to the code user on what provisions must be complied with based on the type of project. Increasing the clarity of the code will increase the compliance rate and result in increased energy savings for these projects.

This proposal places all of the requirements for additions, alterations, renovations, and repairs into a new section in the commercial provisions of the IECC and builds off the work conducted by the ICC SEHPCAC in the development of their existing building proposal. The additions portion of the proposal provides direction on what options are available for demonstrating compliance for projects up to 30% window to wall ratio and for those projects up to 40% window to wall ratio. References into the code are also provided when HVAC, water heating, and lighting systems are included in the project. The alteration portion of the proposal provides clear guidance on how to address alterations that increase fenestration area for the building that exceeds the prescriptive fenestration limits for the building as defined in the code. Exceptions currently included in Section C101.4.3 of the 2012 IECC have been moved into this new section and linked to the applicable references to the building envelope, HVAC, or lighting section. Repairs have been clearly identified and essentially exempted from the requirements of the IECC if they fall within certain defined parameters.

Cost Impact: The code change proposal will not increase the cost of construction.

CE5-13

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

C409 (NEW)-EC-MAKELA.doc

CE6 – 13
C101.4.2, R101.4.2 (IRC N1101.3), IEBC 1207 (NEW)

Proponent: Randall R. Dahmen, P.E., Licensed Wisconsin Commercial Building Inspector, representing self

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE, PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART III WILL BE HEARD BY THE EXISTING BUILDING CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Delete without substitution as follows:

~~**R101.4.2 (N1101.3) Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

PART III – IEBC

Add new text as follows:

<u>SECTION 1207</u>
<u>ENERGY CONSERVATION</u>

<u>**1207.1 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from the IECC.</u>

Reason: The requirements referenced in this code section are issues that deal with existing buildings, specifically, historic buildings. As such, the requirements should be listed in the IEBC. If it is felt that the requirements need to remain as part of the IECC, then it is requested that the requirements be listed/referenced under both the IECC as well as the IEBC, as is commonly done throughout the ICC suite of codes. Having the same language in multiple ICC codes is commonly done throughout the ICC suites for issues such as fire dampers, etc. For example, review IBC 717.5 and IMC 607.5

Cost Impact: The code change proposal will not increase the cost of construction.

CE6-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

PART III – IEBC

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

C101.4.2-EC-DAHMEN.doc

CE7 – 13
C101.4.2, C202 (NEW), R101.4.2, R202 (NEW) (IRC N1101.9 (NEW))

Proponent: Jim Edelson, New Buildings Institute (jedelson@comcast.net), Ric Cochrane, National Trust for Historic Preservation, David Collins, The Preview Group representing The American Institute of Architects

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~ <u>The provisions of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall not be mandatory for *historic buildings*. No provision of this code shall be used to require the *alteration* of an *historic building*.</u>

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**HISTORIC BUILDING.** Any building or structure that is one or more of the following:</u>

1. <u>Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places</u>
2. <u>Designated as historic under an applicable state or local law; or</u>
3. <u>Certified as a contributing resource within a National Register listed or locally designated historic district.</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~ <u>The provisions of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall not be mandatory for *historic buildings*. No provision of this code shall be used to require the *alteration* of an *historic building*.</u>

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

HISTORIC BUILDING. Any building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places
2. Designated as historic under an applicable state or local law; or
3. Certified as a contributing resource within a National Register listed or locally designated historic district.

Reason: The current language for Historic Buildings in the IECC-Commercial, the IECC-Residential and the IEBC is confusing, inconsistent with I-Code conventions for definitions, and does not clearly describe how buildings and districts are listed or determined to be eligible to be listed as historic. The charging language in C101.4.2 contains no fewer than three semi-colons and nine instances of the word "or". This makes the language very difficult to parse. The sentence structure in the current language that addresses eligibility is confusing and obfuscates who does the determinations.

The IECC mixes the definition of "historic building" with the charging language for historic buildings. Not only does this further make the charging language difficult to understand, it makes the language inconsistent with the way the I-Codes deal with definitions. Generally, the I-Codes keep definitions out of the code language and gather all definitions together into a definitions section.

Finally, the language does not align with how buildings and districts are officially designated by the governing authorities as eligible for listing as historic.

This proposal solves these three problems. First, it moves the definition of an historic building to the definitions sections in the IECC and edits the charging language of C101.4.2 to simply refer to that definition. It remedies the confusion caused by the sheer complexity of the defining language by converting the running list of qualifications into a clearly delineated numbered list. Finally, the proposal gives the language clarity and specificity as to how a building is officially determined to be eligible for the various lists of historic buildings. In accordance with the Code of Federal Regulations, Title 36, Chapter I, Part 63, determinations of eligibility for listing in the National Register of Historic Places are made by State Historic Preservation Offices in coordination with the Keeper of the National Register of Historic Places. This is an official process conducted in accordance with federal standards. This proposal aligns the code language with the language of this official process and removes any ambiguity as to who can make determinations of eligibility.

The charging language in the IECC also creates a rather large loophole. Historic buildings as defined by Section C101.4.1 are exempted completely from the code in its entirety. This means that no work being done on an historic building has to comply with the IECC at all - not alterations, not changes of use, not even additions. The definition of "historic building" is rather broad. It includes buildings that are certified as contributing to a local, state or national historic district. These are buildings that generally do not have enough historical significance/character to merit designation on their own, but do have enough to help define the overall significance/character of a district. Yet they are completely exempted from the energy code.

Buildings with historic significance may have social and aesthetic values, and the energy code should not be written in a way that will degrade these values. But rather than wholly exempting historic buildings like the current language in the IECC does, other I-Codes, especially the IBC and IFC, have balanced the protection of historic buildings with the intended goals of the codes. The IECC should follow this example and balance the competing values of historic preservation and energy conservation, rather than granting a wholesale exemption to historic buildings.

This proposal narrows the historic building loophole by eliminating the most egregious part, the exemption for additions to historic buildings. Additions to historic buildings are new construction, and in this case there is no historic character or historic fabric to protect. This change will make additions subject to the provisions of the IECC. However, it ensures that only the addition is subject to the IECC and exempts the historic building itself from any requirements that might be triggered by the addition.

This proposal is one of four proposals in Cycle B to create this consistency for Historic Buildings across the I-codes. The other three proposals are being made to the IECC-Commercial, the IEBC and the IPMC.

Cost Impact: The code change proposal will not increase the cost of construction.

Note: The term 'historic building' currently defined in the IBC, IEBC and IgCC. The definition in the IBC and IgCC is:

> **Historic buildings.** Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

The definition in the IEBC is:

> **Historical Building.** Any building or structure that is listed in the State or National Register of Historic Places: designated as a historic property under local or state designation law or survey; certified as a contributing resource within a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Register of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places.

These proponents have submitted proposals to add this definition to the *International Property Maintenance Code* (PM2-13) and to the *International Existing Buildings Code* (EB1-13)

CE7-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.2-EC- COCHRANE-COLLINS-EDELSON .docm.doc

CE8 – 13
C101.4.2, C202 (NEW), R101.4.2, R202 (NEW) (IRC N1101.9 (NEW))

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.2 Historic buildings. ~~Any buildings or structures that is are listed in the state or national register of historic places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a national register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the national or state registers of historic places either individually or as a contributing building to a historic district by the state historic preservation officer or the keeper of the national register of historic places, are exempt from this code.~~ Alterations and repairs to *historic buildings* shall comply with this code to the extent that such compliance does not compromise the historic nature and function of the building.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

HISTORIC BUILDING. Any building or structure that is:

1. Listed in the State or National Register of Historic Places
2. Designated as a historic property under local or state designation law or survey
3. Certified as a contributing resource within a National or State Register listed or locally designated historic district, or
4. Determined or certified by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places to be eligible to be listed in the State or National Register of Historic Places either individually or as a contributing resource in an historic district.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~ Alterations and repairs to *historic buildings* shall comply with this code to the extent that such compliance does not compromise the historic nature and function of the building.

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

HISTORIC BUILDING. Any building or structure that is:

1. Listed in the State or National Register of Historic Places
2. Designated as a historic property under local or state designation law or survey
3. Certified as a contributing resource within a National or State Register listed or locally designated historic district, or
4. Determined or certified by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places to be eligible to be listed in the State or National Register of Historic Places either individually or as a contributing resource in an historic district.

Reason: The existing requirement exempts historic buildings from all energy efficiency requirements, even those that do not impact the historic value of the building at all, such as lighting controls, attic insulation, or mechanical equipment efficiency. This modification requires energy efficiency measures only where they will leave the historic value of the building undisturbed.

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

Note: The term 'historic building' currently defined in the IBC, IEBC and IgCC. The definition in the IBC and IgCC is:

> **Historic buildings.** Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

The definition in the IEBC is:

> **Historical Building.** Any building or structure that is listed in the State or National Register of Historic Places: designated as a historic property under local or state designation law or survey; certified as a contributing resource within a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Register of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places.

In addition to this proposal, definitions of historic building are proposed in CE7-13, CE9-13 being heard by this committee, PM2-13 being heard by the Property Maintenance Committee and EB1-13 being heard by the Existing Buildings Committee..

CE8-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.2-EC-KRANZ.doc

CE9 – 13
C101.4.2, C202 (NEW), R101.4.2, R202 (NEW) (IRC N1101.9 (NEW))

Proponent: Meg Waltner, Natural Resources Defense Council (mwaltner@nrdc.org), Ryan Meres, Institute for Market Transformation, Russell Unger, Urban Green Council

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~ <u>Historic buildings shall comply with the provisions of this code with the following exceptions, provided that these exceptions shall not apply to any addition to an *historic building* that has not itself been designated an *historic building*. No provision of this code shall be used to require the *alteration* of an *historic building*.</u>

<u>Exceptions:</u>

1. <u>The provisions of Sections C402.</u>
2. <u>The provisions of C405.6.</u>
3. <u>Any portion of an energy system contained within a listed or designated interior.</u>
4. <u>Any provision of this code if the local, state, or federal historic commission having authority deems that compliance with such provision is not feasible or would undermine the historic integrity of the *historic building.*</u>

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**HISTORIC BUILDING.** Any building or structure that is one or more of the following:</u>

1. <u>Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places</u>
2. <u>Designated as historic under an applicable state or local law; or</u>
3. <u>Certified as a contributing resource within a National Register listed or locally designated historic district.</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this~~

~~code.~~ Historic buildings shall comply with the provisions of this code with the following exceptions, provided that these exceptions shall not apply to any addition to an *historic building* that has not itself been designated an *historic building*. No provision of this code shall be used to require the *alteration* of an *historic building*.

Add new definition as follows:

HISTORIC BUILDING. Any building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places
2. Designated as historic under an applicable state or local law; or
3. Certified as a contributing resource within a National Register listed or locally designated historic district.

Reason: This proposal follows a joint proposal by the New Buildings Institute, the National Trust for Historic Preservation, and the American Institute of Architects in two matters. First, it adjusts the structure of the provision on historic buildings to be more in line with standard code syntax by adding a definition of "Historic Building", and then deleting the definitional language from the charging provision. Second, it removes additions to historic buildings from the exemption to the energy code.

In addition, this language narrows the exemptions for Historic Buildings from the current blanket exemption to a narrower set of exemptions. There are many reasons to narrow the exemptions.

The current blanket exemption does not have the nuance that one would expect of a code, in which specific exemptions are made for clear and justifiable reasons; consequently, the exemption leads to some very counter-intuitive results. For example, is there any reason that water-heating equipment in historic commercial buildings could not or should not meet the performance standards of Table 504.2, or the requirements for temperature controls for such equipment as per 504.3, or the requirements for pipe insulation as per 504.5? The current language exempts historic properties from every one of these requirements. In fact, is there any reason why Section 504, for service water heating, should not pertain in its entirety to historic commercial buildings? Similarly, what is the justification for exempting historic residential buildings from the requirements on snow melt system controls as per 403.8, or from the requirements for energy-conserving measures for pools, as per 403.9?

Clearly a more careful consideration of the justifiable exemptions for historic buildings is in order. The attached proposal takes the approach that historic buildings can and should comply with the provisions of the energy code for interior energy systems, including lighting, hot water, and mechanical systems, while exempting such systems that are within landmarked interiors and in the event that any provision of the code would undermine the historic integrity of the building in the opinion of a local, state or federal historic commission. These exemptions should cover any unforeseen eventualities in which the provisions of the energy code governing interior energy systems could result in a conflict with the maintenance of the historic fabric.

In addition, given the complexities of the building envelope and exterior lighting provisions as they pertain to historic properties, this proposal takes the approach that, for now, historic buildings should continue to be exempted from the envelope and exterior lighting provisions in their entirety. Here, too, however, a more nuanced approach is warranted. For example, is there any reason that the flat roof of a historic building should be exempted from the energy code's requirements for insulation or that the parking lot on a historic property should be exempted from the lighting power provisions? We need to spark a national dialogue on this subject with experts analyzing each section of the envelope and exterior lighting provision of the code and determining which of them would necessitate an exemption for historic properties.

Finally, this proposal requires that additions to historic buildings comply with the energy code in its entirety, unless such addition has itself been deemed historic, as in a 1920's colonial addition to a 17th Century building. That is because additions to historic buildings are not themselves historic and do not deserve special treatment under the code.

Narrowing the exemptions for historic properties serves at least three important purposes. The first is the direct impact on energy use and greenhouse gas emissions. Given the size of landmarked districts, the area of impacted can be quite large. For example, in Manhattan 25% of all lots are either individual landmarks or landmarked districts and some of the individual landmarks, such as the Empire State Building or the Woolworth Building, are enormous skyscrapers. Exempting all such properties from all aspects of the energy code will significantly impede citywide progress on energy efficiency. Moreover, the recent renovation of the Empire State Building has provided a great example of a historic property that has achieved exemplary energy performance through energy retrofits without undermining its historic qualities.

The second is preserving the value of historic properties. One benefit of the energy code is that, as buildings undergo their natural renovation cycles, they are continually upgraded in terms of their energy performance because any new energy system, such as new lights or boilers, need to meet the provisions of the energy code. If historic properties are exempted from such requirements, their systems will become increasingly outmoded and expensive to run, making such properties less desirable in the real estate market.

Finally, a narrowing of the exemptions will help preserve the natural alliance between historic preservation and sustainability. Because of the embodied energy in historic buildings and the many environmental impacts of demolition and construction, saving existing buildings is generally a more sustainable approach. However, exempting historic buildings from all aspects of the energy code could lead to an unnecessary collision between these two agendas, since with the exemption in place the expansion of historic districts and the creation of new historic landmarks will be seen as detrimental to progress in energy efficiency.

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

Note: The term 'historic building' currently defined in the IBC, IEBC and IgCC. The definition in the IBC and IgCC is:

Historic buildings. Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

The definition in the IEBC is:

Historical Building. Any building or structure that is listed in the State or National Register of Historic Places: designated as a historic property under local or state designation law or survey; certified as a contributing resource within a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Register of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places.

In addition to this proposal, definitions of historic building are proposed in CE7-13, CE8-13 being heard by this committee, PM2-13 being heard by the Property Maintenance Committee and EB1-13 being heard by the Existing Buildings Committee..

CE9-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.2-EC-MERES-UNGER-WALTNER.doc

CE10 – 13
C101.4.2, R101.4.2

Proponent: Al Godwin, CBO, CPM, Aon Fire Protection Engineering (al.godwin@aon.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.2 Historic buildings. Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, ~~are exempt from~~ shall comply with all of the provisions of this code.

> **Exception:** Whenever a provision or provisions of this code shall invalidate or jeopardize the historical designation or listing, that provision or provisions shall be permitted to be exempted.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.2 Historic buildings. Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, ~~are exempt from~~ shall comply with all of the provisions of this code.

> **Exception:** Whenever a provision or provisions of this code shall invalidate or jeopardize the historical designation or listing, that provision or provisions shall be permitted to be exempted.

Reason: There is no reason why historical buildings cannot install energy efficient electrical, plumbing, HVAC, etc. There is no justification for total blanket exemption.

Critical historical areas might include the exterior envelope (the outside look), 1st floor entry lobby and perhaps most of the first floor inclusive of specific light fixtures, elevator lobbies on other floors but not the entire building. New lay-in ceilings and lighting on other than the 1st floor usually have no historical significance at all.

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

CE10-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.2-EC-GODWIN.doc

CE11 – 13
C101.4.3, R101.4.3, (IRC N1101.3)

Proponent: Vickie Lovell, InterCode Incorporated, representing The International Window Film Association (vickie@intercodeinc.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building in not increased.

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. <u>Existing single pane fenestration assemblies with surface applied window film to reduce solar heat gain.</u>

~~3.~~ <u>4</u>. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

~~4.~~ <u>5</u>.Construction where the existing roof, wall or floor cavity is not exposed.

~~5.~~ <u>6</u>. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6.~~ <u>7.</u> Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a conditioned space from the exterior shall not be removed,

~~7.~~ <u>8.</u> Alterations that replace less than 50 percent of the luminares in a space, provided that such alterations do not increase the installed interior lighting power.

~~8.~~ <u>9.</u> Alterations that replace only the bulb and ballast within the existing luminares in a space provided that the alteration does not increase the installed interior lighting power.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.3 (N1101.3) Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building in not increased.

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing single pane fenestration assemblies with surface applied window film to reduce solar heat gain.

~~3.~~ 4. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

~~4.~~ 5.Construction where the existing roof, wall or floor cavity is not exposed.

~~5.~~ 6. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6.~~ 7. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a conditioned space from the exterior shall not be removed,

~~7.~~ 8. Alterations that replace less than 50 percent of the luminares in a space, provided that such alterations do not increase the installed interior lighting power.

~~8.~~ 9. Alterations that replace only the bulb and ballast within the existing luminares in a space provided that the alteration does not increase the installed interior lighting power.

Reason: The IECC Section C401.2.1 requires compliance with Sections C402, C403, and C405 for existing buildings that are undergoing alternations and repairs. However, this section of the code (C C101.4.3) clarifies that certain features of the existing building are exempt from the requirements of the IECC.

Surface applied window film to existing fenestration has been added to the list because it can enhance the performance of existing single pane fenestration products for protection from injuries and property damage due to broken glass, reduces ultraviolet transmittance and glare, and improves performance when impacted. The foremost benefit of applied window film to existing windows is reduced solar heat gain and reduced energy use.

Without this addition to the list of exceptions, the code could be interpreted to unnecessarily require replacements of all existing windows to be with new materials and systems as for new construction.

This provision does not change the requirement for new windows when it is cost effective or otherwise desirable for older windows to be totally replaced. However, on some projects for additions, alternations, renovations or repairs simply and inexpensively improving the performance of the existing windows that are still fully functional can contribute to improved and more efficient total building energy use. Not recognizing this alternative to total window replacement in the code can also be a disincentive to make other needed improvements due to the cost of total replacement.

Buildings account for 16 percent of the world's energy consumption, and nearly 40 percent of this total is consumed by the United States. While roughly two percent of commercial floorspace is newly constructed each year, and a comparable amount renovated, the majority of opportunities to improve efficiency over the next several decades will be in existing building stock. Improving the energy efficiency of existing buildings through retrofitting and other measures will create a high-volume, low-cost approach to reducing energy use and greenhouse gas emissions.

Building owners must decide where to rank efficiency projects within a list of competing priorities—social, financial and environmental. Improving energy efficiency through retrofitting existing buildings certainly benefits the environment; however, it also benefits building owners from a cost standpoint. Allowing building owners to have the option to use window film on existing fenestration in order to improve the energy efficiency will create an incentive for reducing energy consumption and greenhouse emissions.

Cost Impact: The proposal will not increase the cost of construction.

CE11-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.3-EC-LOVELL

CE12 – 13
C101.4.3, C202 (NEW)

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Replacement of existing *fenestration*, provided, however, that the area of the replacement *fenestration* does not exceed 25 percent of the total *fenestration area* of an existing building and that the *U-factor* and *SHGC* will be equal to or lower than before the *fenestration* replacement.

~~3~~ 4. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

~~4~~5. Construction where the existing roof, wall or floor cavity is not exposed.

~~5~~6. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6~~7. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,

~~7~~8. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

~~8~~9. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

FENESTRATION AREA. The total area of the fenestration measured using the rough opening and including the glazing, sash, and frame. For doors where the glazed vision area is less than 50 percent of the door area, the fenestration area is the glazed vision area. For all other doors, the fenestration area is the door area, using the rough opening and including the frame.

Reason: Currently when a portion of the fenestration in a store-front or curtain wall building is damaged the IECC requires the replacement fenestration to meet the requirements of the current code. Often times this requires additional construction to the undamaged portions of the fenestration to ensure the code compliant replacement is compatible.

This code change will allow replacement of damaged fenestration in existing buildings to be replaced without requiring the fenestration to meet the current U-factor and SHGC requirements when falling within certain parameters.

The damaged area needing replacement must not exceed 25% of the total fenestration of the building and it must be equal or better than currently installed.

Cost Impact: The code change proposal will not increase the cost of construction.

CE12-13

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

C101.4.3-EC-ELLIS.doc

CE13 – 13
C101.4.3, C101.4.3.1, 202 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.

~~5. Reroofing of roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~

~~6~~ <u>5.</u> Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,

~~7~~ <u>6</u>. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

~~8~~ <u>7</u>. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

<u>**C101.4.3.1 Insulation requirements for roof covering replacements.** For roof covering replacement on an existing building where the insulation is entirely above the deck and where the roof slope is less than two units vertical in 12 units horizontal, the insulation shall conform to the energy conservation requirements as specified in Table C402.2</u>.

<u>**Exception:** Where the required R-value cannot be provided due to thickness limitations presented by existing rooftop conditions, including roof drainage, heating, ventilation and air-conditioning equipment, low door or glazing heights, parapet heights, proper roof flashing heights, the maximum thickness of insulation compatible with the available space and existing uses shall be installed</u>.

Add new definition as follows:

<u>**ROOF COVERING REPLACEMENT.** An alteration consisting of the removal of the existing roof covering, and installation of a new roof covering</u>.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The prescriptive envelope requirement for re-roofing of low-slope roofs under the 2012 IECC is confusing and does not appropriately addresses the technical concerns that often arise during these projects. This proposed change would clarify existing requirements under the IECC, but would not add any new requirements. Also, this proposal is very similar to language adopted on October 31, 2011 by the International Code Council (ICC) as part of the International Green Construction Code (IgCC), Section 1003.3.11 (Code Change #GG722-11).

Application of the 2012 IECC to roof alterations is partly determined by interpretation of Section C101.4.3 (Additions, alterations, renovations or repairs) and exception #5 of that section. The ambiguities in this section and exception, as applied to low-slope roofs with insulation entirely above deck, have created an opportunity for intentional and unintentional misinterpretation. For instance, it is common practice to use a cover board or slip sheet between the primary insulation layer and the roof membrane. If these materials are left in place during the roof replacement process, then the insulation would not be "exposed" and compliance with the IECC as it applies to roof alterations could be avoided.

Cost Impact: This code change proposal will not increase the cost of construction. The proposal clarifies roof recovering. To the extent that even these elements were not being addressed by roof recovering's in the past

Note: While the other International Codes do not defined "roof covering replacement' the IgCC does define 'roof replacement' as follows:

> **ROOF REPLACEMENT.** The process of removing the existing roof covering, repairing any substrate and installing a new roof covering*.*

CE13-13

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

C101.4.3-EC-THOMPSON-SEHPCAC.doc

CE14 – 13
C101.4.3

Proponent: Michael A. Anthony, P.E., University of Michigan, Kevin Folsom, Dallas Theological Seminary, Larry Spielvogel, L. G. Spielvogel, Inc.

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
   <u>5.1. Roofs without insulation in the cavity and where equipment covers more than 10 percent of the roof area</u>
   <u>5.2. Roofs without insulation in the cavity and where a repaired area is less than 100 square feet.</u>
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Reason: Our industry supports all energy conservation efforts but they have to be practical. We need to put a softer edge on the re-insulation requirement however. Often when a roof leak is "repaired" the existing damaged membrane may be removed (exposing the insulation) and wet insulation may be replaced. This might be less than 100 sq. feet. Adding additional insulation thickness (maybe up to twice the thickness) not only adds to the complexity without making any measurable or meaningful improvement in the thermal performance of the building. The net result of this section would be a patch and the wet insulation would be left in place.

Without an exception of this nature, Owners would be required to do the equivalent of updating an entire window just because the glass was broken.

Cost Impact: Granting Owners more scalable options regarding insulating programs over time generally reduces costs though, admittedly, cost impact is site specific.

CE14-13

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

C101.4.3-EC-ANTHONY.doc

CE15 – 13
C101.4.3, C202 (NEW), C402.2.1.1, R101.4.3 (IRC N1101.3), R202 (NEW) (IRC N1101.9 (NEW))

Proponents: Michael. D. Fischer, Kellen Company, representing Center for the Polyurethanes Industry (mfischer@kellencompany.com); Michael D. Fischer, Kellen Company, representing Polyisocyanurate Insulation Manufacturers Association; Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition.

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed.~~ <u>Roof recover or roof repair.</u>
<u>6</u>. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
~~6~~<u>7</u>. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
~~7~~<u>8</u>. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
~~8~~<u>9</u>. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Add new text as follows:

<u>**C402.2.1.1 Roof replacement.** For roof replacements, where the existing roof assembly is part of the *building thermal envelope* and contains insulation entirely above deck, roof replacement shall include compliance with the requirements of Table C402.1.2 or Table C402.2.</u>

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

[B] REROOFING. The process of recovering or replacing an existing *roof covering*. See “Roof recover” and “Roof replacement.”

[B] ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing *roof covering* without removing the existing *roof covering*.

[B] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

[B] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.3 (N1101.3) Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed.~~ Roof recover or roof repair.
6. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

~~6~~7. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,

~~7~~8. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

~~8~~9. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Add new definitions as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

[B] REROOFING. The process of recovering or replacing an existing *roof covering*. See “Roof recover” and “Roof replacement.”

[B] ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing *roof covering* without removing the existing *roof covering*.

[B] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

[B] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

Reason: Fischer (Part I) The current requirements that govern envelope performance requirements during reroofing do not utilize definitions contained in the building codes. The use of the term reroofing in and of itself is overly broad and subject to confusion. Roof replacement, which is the specific condition intended for envelope compliance, provides an important opportunity to decrease building energy use in US buildings. This proposal provides needed clarity to ensure that buildings are evaluated for compliance to current energy code requirements when the roof is replaced. The proposal also improves the exception to ensure that roof repair and recover projects are clearly not intended to bear additional expense that could be burdensome.
Fischer (Part II) The exceptions to applicability of the IECC for reroofing are unclear, and include confusing language. This proposal includes definitions used in the roofing chapter of the IBC in order to better scope the appropriate exceptions to the envelope requirements in the IECC.

The proposed language clarifies that roof replacement triggers the envelope requirements, but only when the roof assembly is part of the thermal envelope and the insulation is entirely above the roof deck. If the insulation is located within an attic cavity, roof replacement itself does not trigger insulation upgrades. The proposal also makes it clear that recover and repairs are not intended to trigger energy upgrades, while ensuring that the opportunity to add roof insulation when the roof is replaced is not missed.

Reason: Dean, Harris, Misuriello, Prindle, Stone: The purpose of this code change is to clarify code requirements related to roofs on existing buildings by distinguishing between roof repairs, roof recovering, and roof replacement. The proposal creates new definitions for each of these actions (Chapter 2), clarifies that repair and recover are exceptions to the code (section C101.4.3), and clarifies that when certain roof replacements occur (new section C402.2.1.1), that the roof must meet the roof insulation requirements in Table C402.1.2 or C402.2.

While the code generally requires additions, alterations, renovations or repairs to comply with the code, the specific application in many instances may not be entirely clear or consistently interpreted and enforced. Roof replacements are a good example of this issue. This code proposal is intended to resolve any interpretation issues related to roof replacement and ensure that proper insulation is installed when the opportunity is presented. It is important that opportunities to improve the efficiency of existing buildings are seized when presented and the replacement of roofs is one such important opportunity.

Cost Impact: The code change proposal will not increase the cost of construction.

Note: The four proposed definitions are terms defined in the IBC, the term 'roof replacement' is also found in the IgCC. The definitions found in the other codes are the same as proposed here.

CE15-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.3-EC-FISCHER-DEAN-HARRIS-MISURIELLO- PRINDLE-STONE.doc

CE16 – 13
C101.4.3, R101.4.3 (N1101.3)

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. <u>Attic insulation shall not be installed unless accessible attic bypasses have been sealed. An attic bypass is any air passageway between a conditioned space and an unconditioned attic.</u>

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.3 (N1101.3) Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. <u>Attic insulation shall not be installed unless accessible attic bypasses have been sealed. An attic bypass is any air passageway between a conditioned space and an unconditioned attic.</u>

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Reason: This has been a requirement in the Minnesota Residential Energy Code for many years, and the cost/benefit of this provision has already been proven as reasonable by its previous adoption into the Minnesota code. The practice of sealing accessible attic bypasses prior to adding additional insulation is highly cost effective as proven by weatherizing 18,000 homes in Minnesota in the past 2 years.

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

CE16-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.3-EC-MANZ.doc

CE17 – 13
C101.4.3.2 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C101.4.3.2 Mechanical systems: Those parts of mechanical systems which are altered or replaced shall comply with Section C403. Additions or alterations shall not be made to an existing mechanical system that will cause the existing mechanical system to become out of compliance with this code. New mechanical systems in existing buildings, including packaged unitary equipment and packaged split systems, shall comply with Section C403.

> **Exception:** Alternate designs that are not in full compliance with this code are permitted where the code official determines that existing building or occupancy constraints make full compliance impractical or where full compliance would be economically impractical.

Existing equipment currently in use is permitted to be relocated within the same floor or same tenant space if removed and reinstalled within the same permit.

Reason: The 2012 IECC does not specifically address mechanical system alterations. This Proposal clarifies that new or altered mechanical systems must comply with the energy code, and provides the Code Official with discretionary authority to approve departures from this requirement where it doesn't make sense for the project.

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

CE17-13

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

C101.4.3.2 (NEW)-EC-NOGLER.doc

CE18 – 13
C101.4.3, C101.4.3.1 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are insulated to full depth with insulation having a minimum nominal value of R-3.0 per inch installed per Section C402.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed.
7. Alterations that replace less than ~~50~~ <u>60</u> percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

<u>**C101.4.3.1 Lighting and motors.** Alterations that replace 60 percent or more of the luminaires in a space enclosed by walls or ceiling-height partitions shall comply with Sections C405. Where less than 60 percent of the fixtures in a space enclosed by walls or ceiling-height partitions are new, the installed lighting wattage shall be maintained or reduced.</u>

<u>Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit, controls shall comply with Sections C405.2.1, C405.2.2.3, C405.2.3, and as applicable C408.3. In addition, office areas less than 300 square feet enclosed by walls or ceiling-height partitions, and all meeting and conference rooms, and all school classrooms, shall be equipped with occupancy sensors that comply with Section C405.2.2 and C408.3.. Where a new lighting panel (or a moved lighting panel) with all new raceway and conductor wiring from the panel to the fixtures is being installed, controls shall also comply with the other requirements in Sections C405.2.2 and C408.3.</u>

<u>Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall have controls that comply with Sections C405.2.1, C 405.2.2, C405.2.3 and C408.3. Those motors which are altered or replaced shall comply with Section C403.2.13.</u>

Reason: These rules provide thresholds for alterations to upgrade lighting efficiency and controls as tenant improvements take place within existing buildings. This takes advantage of interior construction projects to gradually upgrade the overall lighting efficiency. The rules are summarized as follows:

Where 60% of the light fixtures are replaced in any one space, the space must comply with the interior lighting power density (LPD) requirements.

Where light fixtures are being re-circuited or new fixtures are added, the controls for those circuits must meet:

- Manual lighting controls
- Daylight zone controls
- Specific application controls
- Lighting systems functional testing
- Occupancy sensors for offices, classrooms and conference rooms

Where a lighting panel is new or relocated, and has new raceway and wiring to the fixtures:

- Time switch controls, daylight zone controls, and occupancy sensor controls are required per C405.2.2.

Where a space is being enclosed by new partitions

- Full lighting controls are required as they are for new construction.

New or altered motors must meet NEMA Standard MG-1, and fan motors smaller than 1 hp in series terminal units must be ECM motors or have 65% efficiency per NEMA Standard MG-1 at full load.

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

CE18-13

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

C101.4.3-EC-NOGLER.doc

CE19 – 13

C101.4.4, C101.4.5, C101.4.6, R101.4.4, R101.4.5 (IRC N1101.4), R101.4.6, IEBC 1001.3.1.1 (NEW), 1001.3.1.2 (NEW), 1001.3.1.3 (NEW)

Proponent: Randall R. Dahmen, P.E., Licensed Wisconsin Commercial Building Inspector, representing self

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE, PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART III WILL BE HEARD BY THE EXISTING BUILDING CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C101.4.4 Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.~~

~~**C101.4.5 Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

~~**C101.4.6 Mixed occupancy.** Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Delete without substitution as follows:

~~**R101.4.4 Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.~~

~~**R101.4.5 (N1101.4) Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

~~**R101.4.6 Mixed occupancy.** Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of the IECC—Commercial and Residential Provisions.~~

PART III – IEBC

Add new text as follows:

1001.3.1.1 Change in occupancy or use. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with the *International Energy Conservation Code*.

1001.3.1.2 Change in space conditioning. Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with the *International Energy Conservation Code*.

1001.3.1.3 Mixed occupancy. Where a building changes use between either *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of the *International Energy Conservation Code*—Commercial and Residential Provisions.

Reason: The requirements referenced in this code section are issues that deal with existing buildings. As such, the requirements should be listed in the IEBC. If it is felt that the requirements need to remain as part of the IECC, then it is requested that the requirements be listed/referenced under both the IECC as well as the IEBC, as is commonly done throughout the ICC suite of codes. Having the same language in multiple ICC codes is commonly done throughout the ICC suites for issues such as fire dampers, etc. For example, review IBC 717.5 and IMC 607.5

Cost Impact: The code change proposal will not increase the cost of construction.

CE19-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

PART III – IEBC

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

C101.4.4-EC-DAHMEN.doc

CE20 – 13

C101.4.4, C101.4.5, R101.4.4, R101.4.5 (IRC N1101.4)

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.4 Change in occupancy or use. Spaces undergoing a change in occupancy ~~that would result in an increase in demand for either fossil fuel or electrical energy~~ from an F, S or U occupancy to an occupancy other than F, S or U shall comply with this code. Any space that is converted to a dwelling unit or portion thereof, from another use or occupancy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.

> **Exception**: Where the component performance building envelope option in Section C402.1.3 is used to comply with this section, the Proposed UA is permitted to be up to 110 percent of the Target UA. Where the total building performance option in Section C407 is used to comply with this section, the annual energy consumption of the proposed design is permitted to be 110 percent of the annual energy consumption otherwise allowed by Section C407.3 and Section C401.2 (3).

C101.4.5 Change in space conditioning. Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

> **Exception**: Where the component performance building envelope option in Section C402.1.3 is used to comply with this section, the Proposed UA is permitted to be up to 110 percent of the Target UA. Where the total building performance option in Section C407 is used to comply with this section, the annual energy consumption of the proposed design is permitted to be 110 percent of the annual energy consumption otherwise allowed by Section C407.3 and Section C401.2 (3).

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.4.4 Change in occupancy or use. Spaces undergoing a change in occupancy ~~that would result in an increase in demand for either fossil fuel or electrical energy~~ from an F, S or U occupancy to an occupancy other than F, S or U shall comply with this code. Any space that is converted to a dwelling unit or portion thereof, from another use or occupancy shall comply with this code.

> **Exception**: Where the component performance building envelope option in Section C402.1.3 is used to comply with this section, the Proposed UA is permitted to be up to 110 percent of the Target UA. Where the total building performance option in Section C407 is used to comply with this section, the annual energy consumption of the proposed design is permitted to be 110 percent of the annual energy consumption otherwise allowed by Section C407.3 and Section C401.2 (3).

R101.4.5 (N1101.4) Change in space conditioning. Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

Exception: Where the component performance building envelope option in Section C402.1.3 is used to comply with this section, the Proposed UA is permitted to be up to 110 percent of the Target UA. Where the total building performance option in Section C407 is used to comply with this section, the annual energy consumption of the proposed design is permitted to be 110 percent of the annual energy consumption otherwise allowed by Section C407.3 and Section C401.2 (3).

Reason: The existing IECC phrase "Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy…" (from Section C101.4.4) does not reference a standard for predicting energy demand, even in the Commentary, and could be subject to widely different interpretations. Storage, utility and industrial buildings are the most likely building types to have substantially deficient envelopes, and therefore this amendment replaces the current code language with a more straightforward requirement to bring any of those building types up to code when converting them to other uses.

The exceptions appended to both C101.4.4 and C101.4.5 are included to recognize the fact that converting an existing building to full compliance with current energy code is extremely difficult and costly. Conditions such as slab edges, structural thermal bridges, and window configurations cannot be practically remedied in many cases. Therefore, we propose an alternate compliance path allowing either a 10% higher envelope UxA value or a 10% higher Total Building Performance value. This will result in the preservation and adaptive reuse of more existing buildings, which itself is a significant energy conservation measure.

Note that the first sentence in each exception should be deleted if a separate proposal for a "component performance" building envelope U-value trade-off option is not approved.

Cost Impact: The code change proposal will not increase the cost of construction, it will decrease the cost.

CE20-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.4.4-EC-KRANZ.doc

CE21 – 13
C101.4.7 (NEW)

Proponent: John R. Norris, P.E., Fibrebond Corporation, representing self (bob.norris@fibrebond.com)

Add new text as follows:

C101.4.7 Exempt buildings. Buildings exempt from the provisions of the *International Energy Conservation Code,* include buildings designed for purposes other than general space comfort conditioning. Any building where heating or cooling systems are provided which are designed for purposes other than general space comfort conditioning. Buildings included in this exemption include:

1. Electrical equipment switching buildings which provide space conditioning for equipment only and in which no operators work on a regular and are less 1,000 square feet.

Reason: Additional insulation in these buildings will increase the amount of heat retained, thus making the air-conditioner run more often. It is not practical to comply with the *International Energy Conservation Code* envelope requirements.

Cost Impact: The code change proposed will not increase the cost of construction it will decrease the construction cost by as much as $11.30 per square foot depending on the Climate Zone. In addition there will be a monthly savings based on energy consumption. Actual savings will vary by Climate Zone. The useable area of the building is reduced by about 9% and larger buildings may be required to maintain clearances for equipment.

CE21-13

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

C101.4.7 (NEW)-EC-NORRIS.doc

CE22 – 13
C101.5.1, R101.5.1 (N1101.5)

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition.

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.5.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that demonstrate compliance with ~~meet~~ the ~~intent~~ requirements of this code.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R101.5.1 (N1101.5) Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that demonstrate compliance with ~~meet~~ the ~~intent~~ requirements of this code.

Reason: The purpose of this code change is to clarify the code. Specifically, this proposal improves sections C101.5.1 and R101.5.1 by changing the reference from the "intent" to the "requirements" of the code and refocuses compliance materials on demonstrating compliance. As a result of this improved language, in order to be approved, compliance materials such as computer software or worksheets must be designed to demonstrate that a project meets the *requirements* of the IECC, not simply the "intent" of the IECC.

The current code language is vague because of the reference to the "intent" of the code. Presumably this is a reference to Sections C101.5.1 and R101.3, which provides no guidance as to specific compliance requirements. Alternately, some may claim that this language permits a subjective interpretation of "intent" by the authority enforcing the IECC. Neither interpretation is a suitable substitute for the specific requirements of the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE22-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.5.1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE23 – 13
C101.5.2, C402.1, R101.5.2 (IRC N1101.6), R402.1 (IRC N1102.1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C101.5.2 Low energy buildings.** The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:~~

1. ~~Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.~~
2. ~~Those that do not contain *conditioned space*.~~

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.

Exception: The following low energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

~~**R101.5.2 (N1101.6) Low energy buildings.** The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:~~

1. ~~Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.~~
2. ~~Those that do not contain *conditioned space*.~~

Revise as follows:

R402.1 (N1102.1) General (Prescriptive). The building thermal envelope shall meet the requirements of Sections R402.1.1 through R402.1.4.

Exception: The following low energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The proposal moves an existing exception found in each Administration chapter to the building thermal envelop provisions in C402 and R402. Chapter 1 should not be the location of specific code requirements nor exceptions to such requirements. Chapter 1 will be the location where exceptions to the scope of the code are provided. However such is not the case with these exceptions. These exceptions are for only the envelope and these buildings still need to comply with the requirements for lighting and HVAC systems.

Locating the exceptions at the beginning of the building envelope provisions places the exception immediately with the relevant requirements. This location does reduce the potential for people to interpret that low energy buildings are exempt from the code.

The proposed text is reworded slightly to reflect its location as an exception with Section 402. The change is editorial.

Cost Impact: This code change proposal will not increase the cost of construction. This is editorial in nature.

CE23-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C101.5.2-EC-THOMPSON-SEHPCAC.doc

CE24 – 13
C101.5.2, C202 (NEW)

Proponent: Vickie Lovell, InterCode Inc., representing National Greenhouse Manufacturers Association (vickie@intercodeinc.com)

Revise as follows:

C101.5.2 Low energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h · ft^2 (10.7 W/m^2) or 1.0 $watt/ft^2$ (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. <u>Greenhouses.</u>

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**GREENHOUSE.** A structure or a separate area of a building that maintains a specialized environment essential for the cultivation, protection or maintenance of plants.</u>

Reason: (for 101.5.2) Energy codes and standards have historically applied to buildings intended primarily for human occupancy and use. There are structures, buildings and space uses where strict application of the code poses increasing challenges. All types of agricultural buildings including barns, livestock shelters, sheds, and stables are unique structures in design, construction and operation and different from other commercial buildings in terms of internal loads, schedules, and building usage. Included in those types of structures are greenhouses and separated portions of buildings whose primary function is the cultivation, protection or maintenance of plants.

This proposal exempts greenhouses or separated portions of buildings whose primary function is the cultivation, protection or maintenance of plants from the building thermal envelope of the International Energy Conservation Code. This code change is intended to provide clarity to what the code already says about greenhouses, and what parts of the energy code should be required for compliance.

Strict application of the building envelope provisions of the code in greenhouses is cost prohibitive. Compliance with the building thermal envelope for greenhouses may actually be counterproductive, even detrimental to plant growth, since most plants require controlling the available natural light and highly specialized temperature-controlled conditions. Arbitrarily changing growing conditions can result in reduced output for greenhouse growers, and will have serious negative consequences to the US agricultural/horticultural/floricultural economy. Therefore, this topic merits thoughtful consideration of the implications and ramifications of requiring greenhouses to comply with the entirety of the IECC.

Although the current title of section C101.5.2 is somewhat narrow in scope, it provides for some exemptions to the building thermal envelope provisions in the code. The current provisions in Section C101.5.2 would exempt such buildings from the thermal envelope provisions in the code if they did not contain conditioned space (room or space within the building that is being heated or cooled) or the peak design rate of energy use was less that 1 watt per square foot for space conditioning purposes. However, some greenhouses do contain conditioned space that exceeds the stated peak connected load. In reality, the whole point of a greenhouse is to control a unique environment for the cultivation, protection or maintenance of plants, and <u>such environment is not intended to maintain suitable conditions specifically for human occupancy</u>. Currently such buildings are not exempt from the building thermal envelope provisions of the code. But greenhouses should be exempt.

Other requirements of the IECC and the IBC would still apply to Group U greenhouses. All other building code requirements would still apply for structural, fire, egress, accessibility for such cases where a greenhouse is also used as a retail business, such as garden centers and retail stores that sell plants to the public. This exemption is NOT intended to apply to retail businesses who may display plants and flowers in regular buildings that are not intended to be greenhouses and are environmentally controlled as retail spaces. This would not apply to office buildings and atriums where plants are displayed for aesthetical purpose. But it could capture botanical gardens which also maintain a specialized environment. In such businesses, the plants may be able to survive in the ambient temperature without specifically managing their growing conditions and environment. The proposed definition makes it clear that it is a unique climate controlled environment that defines a greenhouse or similar facility.

Some universities maintain greenhouses for research and studies in horticulture and should be exempt. In these cases, the IBC building, fire structural and other such requirements for mercantile, business and education still apply if the greenhouse is permitted as a Group B, E or M use or occupancy. These IBC provisions based on occupancy are primarily for the comfort and/or protection of people, and appropriately should apply. All Group U provisions of the IBC would still apply. Additionally, the IECC requirements for HVAC would still apply.

The proposed language is based on a current exemption used in the energy code of the State of Wisconsin. A NY Department of State Codes Division opinion on this topic considers all buildings used primarily for agricultural purposes as commercial processes and do not need to comply with the energy codes of the state based upon an ASHRAE 90.1 exemption. This included any greenhouse whether built on a commercial or residential building property site since the greenhouse is not designed for occupancy and falls under their view of a “commercial processes”.

The initiatives to make this industry more energy efficient and sustainable are in motion. The USDA and other federal agencies and private organizations are making huge strides in helping growers be more energy efficient and sustainable by using soil amendments, reducing runoff from irrigation, using appropriate methods of reducing energy consumption, using improved pest management methods, reducing potable water or other natural surface or subsurface water resources, reducing waste, and promoting organic growing.

The current IECC requirements that reduce energy use for other aspects of greenhouses are appropriate EXCEPT the requirements that impede or inhibit the growth of plants, which is the primary function of a greenhouse.

(Section 202) The word “greenhouse” conjures up diverse images as to what a greenhouse might look like including the numerous ways plants are cultivated, marketed and sold. However, this definition captures the primary purpose of a greenhouse, which is to create unique environmental conditions inside a structure or a separated portion of a building that are ESSENTIAL for the cultivation, protection or maintenance of plants. This proposed definition is intended to exclude a retail business owner that brings plants indoors temporarily for display or seasonal promotions.

That environment includes control of the available natural or artificial light, managing the temperature and humidity, dispersing and managing water and controlling the growing medium regardless of the outside climate conditions. If that specific environment is not maintained, the plants cannot survive.

Previous code discussions regarding greenhouses have often bogged down because the focus gets shifted to whom or how the plants are being marketed and sold, public access or not, and other conditions. However, that information is irrelevant to this definition. The proposed definition makes it clear that **the primary descriptive feature of a greenhouse is the unique environment that must be maintained in order for the plants inside the greenhouse to survive.**

Cost Impact: This code change proposal will not increase the cost of construction.

CE24-13

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

C202-GREENHOUSE (NEW)-EC-LOVELL.doc

CE25 – 13
C101.5.2

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Revise as follows:

C101.5.2 Low energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h – ft^2 (10.7 W/m^2) or 1.0 $watt/ft^2$ (10.7 W/m^2) or floor area for space conditioning purposes.
2. Those that do not contain conditioned space.
3. <u>Agricultural buildings.</u>

Reason: The purpose of this proposal is to ensure that buildings or portions of buildings used for agricultural purposes are exempt from the code when appropriate and likewise have to comply with appropriate provisions of the code. Energy codes and standards have historically applied to buildings intended primarily for human occupancy and use. There continue to be building and space uses where strict application of the code poses increasing challenges and can take considerable administrative time. One of those is agricultural use buildings. Through this code change it is hoped that additional clarity can be provided for agricultural use buildings as to when they are or are not required to meet the code. It is important to note that the current language in the parent section C101.5.2 limits such exemptions to only the building thermal envelope provisions in the code. Any HVAC, service water heating and/or lighting systems in such buildings would still be required to meet the provisions of the code.

Agricultural buildings such as barns, livestock shelters, sheds, and stables are commercial buildings as defined in the code but are much different in design, construction, and operation from other commercial buildings in terms of internal loads, schedules, and building usage. The current provisions in Section C101.5.2 would exempt such buildings from the thermal envelope provisions in the code if they did not contain conditioned space (room or space within the building that is being heated or cooled) or the peak design rate of energy use was less that 1 watt per square foot for space conditioning purposes. What about buildings that do contain conditioned space that exceed the stated peak connected load but that require such conditioning for other than human comfort conditions? Currently such buildings are not exempt from the building thermal envelope provisions of the code and should be if for no other reason than to specifically state the applicability of the code to these buildings and in so doing eliminate the situation where other buildings that should comply are being exempted.

Cost Impact: The code change proposal will not increase the cost of construction.

CE25-13

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

C101.5.2-EC-MAKELA.doc

CE26 – 13
C101.5.2.1 (NEW), C202 (NEW), C402.1.3 (NEW)

Proponent: Tim Nogler, Washington State, representing Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C101.5.2.1 Semi-heated spaces. A *semi-heated space* shall meet all of the *building thermal envelope* requirements, except that insulation is not required for opaque wall assemblies. Component performance calculations involving semi-heated spaces shall calculate fully insulated opaque walls for the Target UA calculation, and Total Building Performance calculations involving semi-heated spaces shall calculate fully insulated opaque walls for the Standard Reference Design.

C402.1.3 Semi-heated spaces. All spaces shall comply with the requirements in Section C402 unless the spaces meet the definition for semi-heated spaces. For semi-heated spaces, the building envelope shall comply with the same requirements as that for conditioned spaces in Section C402. Semi-heated spaces shall be calculated separately from other conditioned spaces for compliance purposes. Building envelope assemblies separating conditioned space from semi-heated space shall comply with exterior envelope insulation requirements. When choosing the un-insulated wall option, the wall shall not be included in Component Performance Building Envelope Option calculation.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

SEMI-HEATED SPACE : An enclosed space within a building, including adjacent connected spaces separated by an un-insulated component, including, but not limited to basements, utility rooms, garages, corridors, which:

1. Is heated but not cooled, and has a maximum heating system output capacity of 3.4 Btu/(h-ft^2) but not greater than 8 Btu/(h ft^2)
2. Is not a cold storage space or frozen storage space.

Reason: This proposal supplements the concept of "low energy buildings" with a separate category of "semi-heated spaces." Semi-heated spaces allow just enough heat for freeze protection, and are exempt from wall insulation only, while low-energy buildings are exempt from all thermal envelope requirements.

The effect of this proposal is that buildings with less than 1 watt per SF of heating will still be considered as unheated and require no thermal envelope protection at all, while those with 1 – 2 watts per SF of heating (semi-heated spaces) require no opaque wall insulation, but require all other components such as roof, slab and windows to meet code requirements.

This has been an important concept in the Washington State energy code for many years, allowing less expensive construction for buildings such as warehouses and water treatment plants that are only heated enough for freeze protection. When such buildings are converted to conditioned space at a future point in their lives, it is relatively easy to add the wall insulation, and all the other building envelope components are already code-compliant.

Note that references to the "component performance" option and "target UA calculations" coordinates with the proposal to add those building envelope compliance options.

Cost Impact: The code change proposal will not increase the cost of construction.

CE26-13

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

C101.5.2.1 (NEW)-EC-NOGLER.doc

CE27 – 13
C101.5.3 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Add new text as follows:

C101.5.3 Equipment buildings. Buildings that comply with all of the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate buildings with floor area no more than 500 square feet (50 m^2).
2. Are intended to house electronic equipment with installed equipment power totaling at least 7 watts per square foot and not intended for human occupancy.
3. Have heating system capacity is no greater than 5 kW (17,000 Btu/hr) and heating thermostat setpoint is restricted to no more than 50°F (10°C).
4. Have an average wall and roof U-factor less than 0.120 in climate zones 1-5 and less than 0.200 in climate zones 6 through 8.
5. Comply with the roof solar reflectance and thermal emittance provisions for Climate Zone 1.

Reason: The application of energy codes and standards to buildings not intended primarily for human occupancy and use continue to pose increasing challenges to the strict application of the code. Equipment buildings, shelters, or sheds are installed to protect electronic equipment from the weather and provide primarily cooling conditioning. Heating is installed for emergency backup operation and is typically limited to 40°F or less by a setpoint. Due to the high density of electronic equipment installed, heat is rarely needed and cooling predominates. In this situation, less insulation is actually desirable from an annual energy use standpoint.
This exemption is limited to stand alone equipment buildings no more than 500 square feet in area. Simplified insulation requirements that apply to an average of the roof and wall insulation are provided. This type of building is often made with 3" concrete, internal foam insulation, and a plywood interior with similar construction for roof and walls. To reduce insulation requirements, the ASHRAE 90.1 option may be pursued, as the building would qualify as a semi-heated space. The U-factors required for semi-heated spaces and available in standard construction are listed below, along with the U-factors required in the proposal. The proposed requirements can be met by readily available concrete, wood, or steel frame construction.

Target U-Factors for Equipment Shelters	U-factor
Semi-heated U-factors from ASHRAE 90.1-2010	
CZ-1 Semi-heated average wall/roof U-factor	0.251
CZ-5 Semi-heated average wall/roof U-factor	0.097
CZ-8 Semi-heated average wall/roof U-factor	0.087
Wall U-factors based on Appendix A, ASHRAE 90.1-2010	
Industry Standard: 3" Concrete with R-10	0.114
Metal studs, R-13, no continuous insulation	0.113
Wood studs, R-11, no continuous insulation	0.096
3" Concrete with R-5 insulation	0.195
Metal studs, R-6 insulation, no continuous insulation	0.184
Proposed Equipment Shelter Average Wall & Roof U-factor	
Climate Zone 1-5; Average U-factor shall be less than	**0.200**
Climate Zone 6-8; Average U-factor shall be less than	**0.120**

The basis of the exemption is that there is significant equipment installed that needs cooling most of the year. In this situation, less insulation reduces annual energy cost because it allows for beneficial heat loss. At around 7 watts per square foot of equipment load, the heat loss is offset by the equipment load, with the proposed insulation resulting in very little heating load.
It is important to note that this exemption applies to the building thermal envelope provisions only. Any HVAC, service water heating, and/or lighting systems in such buildings would still be required to meet the provisions of the code. Through this code change it is hoped that additional clarity can be provided for equipment buildings as to when they are or are not required to meet the building thermal envelope provisions of the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE27-13

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

C101.5.3 (NEW)-EC-MAKELA.doc

CE28 – 13
C102.1, R102.1

Proponent: (Part I) Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships **(Part II)** Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition.

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C102.1 General. This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the ~~intent~~ requirements of this code.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R102.1 General. This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the ~~intent~~ requirements of this code.

Reason: The purpose of this code change is to clarify the code. This proposal removes uncertainty from the IECC by clarifying that alternative materials, methods of construction, designs, or systems still must meet the actual requirements, not just the "intent" of the IECC.

The current code language is vague because of the reference to the "intent" of the code. Presumably this is a reference to Section R101.3, which provides no guidance as to specific compliance requirements. Alternately, some may claim that this language permits a subjective interpretation of "intent" by the authority enforcing the IECC. Neither interpretation is a suitable substitute for the specific requirements of the code.

The current language may be viewed by some as creating a loophole that allows a code user to avoid meeting the requirements of the IECC while claiming that a product or system meets a subjective interpretation of the IECC's "intent." The lack of specificity places the code official in a difficult, and potentially risky position of making judgments based on a subjective interpretation of the code's "intent."

Cost Impact: The code change proposal will not increase the cost of construction.

CE28-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE29 – 13

C102.1, C102.1.1, C102.1.2 (NEW), R102.1, R102.1.1 (IRC N1101.7), R102.1.2 (NEW)

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C102.1 General. ~~This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the intent of this code.~~ <u>The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code.</u>

C102.1.1 ~~Above code~~ <u>Alternate</u> programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to <u>meet or</u> exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. ~~The requirements identified as "mandatory" in Chapter 4 shall be met.~~

<u>**C102.1.2 Accredited programs and designs.** The code official or other authority having jurisdiction shall be permitted to accept alternative national programs and designs that have received accreditation by an independent accreditation body. The independent accreditation body shall certify programs or designs as meeting or exceeding the energy efficiency required by this code. Buildings and designs that have received approval in writing and are verified by an approved party shall be considered in compliance with this code.</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R102.1 General. ~~This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been *approved* by the *code official* as meeting the intent of this code.~~ <u>The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code.</u>

R102.1.1 (N1101.7) ~~Above code~~ <u>Alternate</u> programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to <u>meet or</u> exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. ~~The requirements identified as "mandatory" in Chapter 4 shall be met.~~

R102.1.2 Accredited programs and designs. The code official or other authority having jurisdiction shall be permitted to accept alternative national programs and designs that have received accreditation by an independent accreditation body. The independent accreditation body shall certify programs or designs as meeting or exceeding the energy efficiency required by this code. Buildings and designs that have received approval in writing and are verified by an approved party shall be considered in compliance with this code.

Reason: The last section is most important. It sets the stage for accrediting programs outside the code as at least as good as code. Some programs, such as RESNET's HERS are currently too proprietary to name in the code; however, they might be accredited, perhaps with restrictions, then that existing infrastructure can help deliver efficient homes. Just as important, there will be a variety of good programs that can help deliver energy efficiency. Some local, some national, some public, some private, some focused on specific types of homes, others broad; all can help. The code official does not have time to look at all the individual programs. We need a mechanism to accredit those programs or their energy efficient designs, This is a way to help deliver verified energy efficiency where this is acceptable to the code official. Code officials need a chance to catch their breath.

The "General" section lifts code text from the IRC to better describe the flexibility in the IECC.

In the middle section above, the IECC is made consistent with the I-code concept of potentially approving an alternative that is at least as good as the code, "meet or exceed", as in this change. It makes no sense to meet an alternative then go back and say to meet the code too, so the "mandatory" sentence was removed.

Cost Impact: The code change proposal will not increase the cost of construction.

CE29-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1-EC-CONNER.doc

CE30 – 13
C102.1.1, R102.1.1 (IRC N1101.7)

Proponent: (Part I) Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships **(Part II)** Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition.

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C102.1.1 Above code programs. The ~~*code official* or other~~ authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as “mandatory” in Chapter 4 shall be met.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R102.1.1 (N1101.7) Above code programs. The ~~*code official* or other~~ authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. The requirements identified as “mandatory” in Chapter 4 shall be met.

Reason: The purpose of the proposed code change is to clarify the code -- this proposal clarifies that only the “authority having jurisdiction” can determine whether an alternative program qualifies as an “above code program” that can be used to demonstrate compliance with the IECC.

Since section C102.1.1 allows buildings to opt out of local energy code compliance and enforcement (except as to mandatory measures) where they are approved by an “above code program,” there should be a high standard for such programs and such programs should only be approved by the authority having jurisdiction.

- In some jurisdictions, the code official will be the “authority having jurisdiction”, so this proposal will not take that authority away from the code official.
- For jurisdictions in which the state or locality is the authority having jurisdiction (and not the individual code official), this proposal will ensure that only the proper authority makes the decision whether an alternative program meets or exceeds the IECC’s requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

CE30-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1.1 #1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.docc

CE31 – 13
C102.1.1, R102.1.1 (IRC N1101.7)

Proponent: Don Surrena, CBO, National Association of Home Builders (NAHB) (dsurrena@nahb.org) and Craig Conner, Building Quality, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C102.1.1 Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. ~~The requirements identified as "mandatory" in Chapter 4 shall be met.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R102.1.1 (N1101.7) Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. ~~The requirements identified as "mandatory" in Chapter 4 shall be met.~~

Reason: (Surrena): The key element of an above code program is that it must meet or exceed the energy efficiency requirements of the IECC. Requiring such a program to also meet the detailed prescriptive requirements labeled as "mandatory" in the IECC defeats the purpose of performance based above code program. This code change proposal will allow flexibility in the methodology used for any above code program to meet or exceed the minimum energy efficiency requirements of the IECC.
(Conner): This change corrects the erroneous use of the term "*mandatory*". This moves the specification of what can be traded off with the performance approach into the code text about the performance approach, rather than spreading that information throughout the code, as was in energy codes prior to 2006.

The word "*shall*" and the concept of "*mandatory*" is woven throughout the I-codes. It is important that the energy code use "shall" correctly. The IRC definition is

> ***SHALL**. The term, when used in this code, is construed to mean "mandatory".*

Cost Impact: The code change proposal will not increase the cost of construction.

CE31-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1.1-EC-CONNER-SURRENA.doc

CE32 – 13
C102.1.1, R102.1.1, (N1101.7)

Proponent: (Part I) Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships **(Part II)** Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C102.1.1 Above code programs. The *code official* or other authority having jurisdiction shall be permitted to ~~deem~~ approve a national, state or local energy efficiency program as an additional method of demonstrating compliance with this code, provided that:

1. The program is administered by a party who is independent from the parties involved in the construction or ownership of the *building;*
2. A review of all program requirements is conducted;
3, Documentation and analysis shows that the requirements of this program ~~to~~ meet or exceed all of the energy efficiency requirements of ~~required by~~ this code; and
4. Program compliance is verified by a party who is independent from the parties involved in the construction or ownership of the *building*.

Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. Under such a program, the requirements identified as "mandatory" in Chapter 4 shall be met.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R102.1.1 (N1101.7) Above code programs. The *code official* or other authority having jurisdiction shall be permitted to ~~deem~~ approve a national, state or local energy efficiency program as an additional method of demonstrating compliance with this code, provided that:

1. The program is administered by a party who is independent from the parties involved in the construction or ownership of the *building;*
2. A review of all program requirements is conducted;
3, Documentation and analysis shows that the requirements of this program ~~to~~ meet or exceed all of the energy efficiency requirements of ~~required by~~ this code; and
4. Program compliance is verified by a party who is independent from the parties involved in the construction or ownership of the *building*.

Buildings *approved* in writing by such an energy efficiency program shall be considered in compliance with this code. Under such a program, the requirements identified as "mandatory" in Chapter 4 shall be met.

Reason: The purpose of the proposed code change is to establish new requirements for above code programs and to otherwise clarify the code. This proposal outlines specific criteria that must be applied in the determination of whether an alternative program is an "above code program" that may be allowed as a substitute for IECC compliance and code official enforcement.

Since section C102.1.1 allows buildings to opt out of local energy code compliance and enforcement (except as to mandatory measures) where they are approved by an "above code program," there should be a high standard for such programs. The proposed changes ensure that any alternative program will have the following crucial elements:

- Third-party administration of the alternative program
- Requirements that meet or exceed the IECC requirements
- Documentation and analysis to support equivalence
- Independent verification of compliance

By contrast, the current language of section C102.1.1 gives no guidance to the authority having jurisdiction regarding how to determine whether a program is "above code" and should qualify as acceptable as an alternative compliance path. Given the recent flood of programs around the country that claim to be "above-code" and/or "green," it is important that the IECC set the ground rules for how jurisdictions should evaluate these programs as alternatives to traditional code compliance and enforcement.

Cost Impact: The code change proposal will not increase the cost of construction.

CE32-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1.1 #2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE33 – 13
C102, C102.1.1 (NEW), R102, R102.1.1 (NEW)

Proponent: Don Surrena, CBO, National Association of Home Builders (NAHB) (dsurrena@nahb.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

SECTION C102
~~ALTERNATE MATERIALS METHOD OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS~~
APPLICABILITY - DUTIES AND POWERS OF THE BUILDING OFFICIAL

C102.1.1 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. Compliance with the specific performance-based provisions of the International Codes in lieu of specific requirements of this code shall also be permitted as an alternate.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

SECTION R102
~~ALTERNATE MATERIALS—METHOD OF CONSTRUCTION, DESIGN OR INSULATING SYSTEMS~~
APPLICABILITY - DUTIES AND POWERS OF THE BUILDING OFFICIAL

R102.1.1 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. Compliance with the specific performance-based provisions of the International Codes in lieu of specific requirements of this code shall also be permitted as an alternate.

Reason: The proposed new Section R102.1.1 is the exact same language used in IRC Section 104.11, IBC Section 104.11, IFC Section 104.9, IMC Section 105.2, IPC Section 105.2, and IFGC Section 105.2 and this code change proposal is needed to correlate and be consistent with the other I-Codes.

Cost Impact: The code change proposal will not increase the cost of construction.

CE33-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C102.1.1 (NEW)-EC-SURRENA.doc

CE34 – 13
C102.1.1 (NEW), Chapter 5 (NEW), R102.1.1 (NEW), Chapter 5

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

<u>**C102.1.1 ICC 700 option.** Buildings with a certificate of compliance stating the building complies with the ICC 700 Chapter 7 energy efficiency requirements at the Bronze level or above according to Table 303 of ICC 700 shall be considered in compliance with this code. The certificate of compliance shall be from an approved or accredited source.</u>

Add new standard to Chapter 5 as follows:

ICC

<u>ICC 700 National Green Building Standard</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

<u>**R102.1.1 ICC 700 option.** Buildings with a certificate of compliance stating the building complies with the ICC 700 Chapter 7 energy efficiency requirements at the Bronze level or above according to Table 303 of ICC 700 shall be considered in compliance with this code. The certificate of compliance shall be from an approved or accredited source.</u>

Add new standard to Chapter 5 as follows:

ICC

<u>ICC 700 National Green Building Standard</u>

Reason: ICC 700 was built around the I-code family. For example, most of the requirements in the IECC are simply mandates (without points) in ICC 700. The 2012 ICC 700 version the “bronze” level equivalent to the 2012 IECC. With the verification, training, and other support already available and in use, ICC 700 could become one way of showing IECC compliance. Although the ICC 700 user would usually choose to go beyond the energy chapter, that would not be required to comply with the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE34-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

CE35 – 13

C103.2, C103.2.1 (NEW), C103.2.1.1 (NEW), C103.2.1.2 (NEW), C103.2.2 (NEW), C103.2.2.1 (NEW), C103.2.2.2 (NEW), C103.2.3 (NEW), C103.2.4 (NEW), C103.2.5 (NEW), C103.3, C104.2, C104.8, C202 (NEW), R103.2 (IRC N1101.8), R103.2.1 (NEW) (IRC N1101.8.1), R103.2.1.1 (NEW) (IRC N1101.8.1.1), R103.2.1.2 (NEW) (IRC N1101.8.1.2), R103.2.2 (NEW) (IRC N1101.8.2), R103.2.2.1 (NEW) (IRC N1101.8.2.1), C103.2.2.2 (NEW) (IRC N1101.L8.2.2), R103.2.3 (NEW) (IRC N1101.8.3), R103.2.4 (NEW) (IRC N1101.8.4), R103.2.5 (NEW) (IRC N1101.8.5), R103.3, R104.2, R104.8, R202 (NEW)

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C103.2 Information on construction documents. Construction documents ~~shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building systems and equipment as herein governed. Details shall include, but are not limited to, as applicable, insulation materials and their R-values; fenestration U-factors and SHGCs; area-weighted U-factor and SHGC calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with wattage and control narrative; and air sealing details.~~ required for a building permit shall include a statement by one or more registered design professionals that the project design complies with or is exempt from this code, an *energy analysis* for the building design based on the chosen compliance strategy, the design itself, utilizing the specific energy values indicated by the *energy analysis*, a commissioning plan for mechanical and electrical systems where required and a description of the progress, commissioning and final inspections and tests required by this code for the project. Electronic media documents are permitted to be submitted when approved by the *code official*.

> **Exception:** Project designs that are entirely exempt in accordance with this code are not required to provide either the *energy analysis*, supporting design documentation, commissioning plan or inspections listing required by this code.

C103.2.1 Registered design professional statement of compliance or exemption. Construction documents submitted for a building permit shall include a statement by at least one registered design professional that the project design complies with or is exempt from this code. If the project design is exempt or partially exempt from this code, the citation shall be provided that allows the exemption.

C103.2.1.1 Statements of compliance or exemption. The statement of compliance shall read as follows: "To the best of my knowledge, belief and professional judgment, all work under this application is in compliance with this code." The statement of exemption shall read as follows: "To the best of my knowledge, belief and professional judgment, all work under this application is exempt from this code in accordance with Section ____. If the proposed work is partially exempt, the registered design professional shall use the statement of compliance and note the exempted work, providing the code citation allowing the exemption.

C103.2.1.2 Responsible registered design professional. If the project design team utilizes no energy trade-offs among design disciplines, each registered design professional of record may sign a statement of compliance with this code for the respective discipline. If the project design team utilizes energy trade-offs among design disciplines, at least one registered design professional shall sign the statement of compliance with this code for the entire project, including all disciplines.

C103.2.2 Energy analysis. The construction documents shall include an *energy analysis* showing the strategy for determining project design compliance with this code, and shall indicate the specific values for each unit of material, equipment and system that such analysis indicates must be met in the completed construction. The *code official* may require that the registered design professional show the values determined by the energy analysis in a table indicating, for each material, system or equipment type, the item, its required energy value, the citation from this code and the drawing reference where the item is drawn or described.

C103.2.2.1 Prescriptive approach. If the compliance strategy uses the prescriptive approach in conjunction with the mandatory requirements, such values will be derived from provisions referenced in either Section C401.2-1 or Section C401.2-2, or from provisions referenced in Section R401.2.

C103.2.2.2 Performance approach. If the compliance strategy uses the performance approach in conjunction with the mandatory requirements, such values will be derived from provisions referenced in either Section C401.2-1 or Section C401.2-3, or from provisions referenced in Section R405.

C103.2.3 Supporting design documentation. The construction documents shall indicate materials, systems and equipment for the proposed design as identified in the *energy analysis*, and shall specify the energy values determined by the analysis. Construction documents shall be fully coordinated and of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, materials, systems and equipment as herein governed. Details shall include as applicable, but are not limited to, envelope assembly U-factors; insulation materials and their R-values; fenestration areas, U-factors and SHGCs; area-weighted U-factor and SHGC calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with input wattage, ballast type and control narrative; lighting power densities; and air sealing details for the *building thermal envelope* and penetrations through it.

C103.2.4 Commissioning plan. Where applicable, a commissioning plan shall be provided in the construction documents in accordance with Section C408. Construction document notes shall clearly indicate provisions for commissioning and completion requirements in accordance with such section. Copies of all documentation shall be made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

C103.2.5 Listing and description of required inspections and testing. The construction documents shall include a listing of the applicable progress, commissioning and final inspections and testing required by this code, when and how often each should be required in the project schedule, whether and what percentage of sampling will be permitted, applicable reference standards and the citation for the inspection or test.

C103.3 Examination of documents. The *code official* shall examine or cause to be examined the ~~accompanying~~ construction documents and shall ascertain whether the proposed construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

C104.2 Required approvals. Required inspections and testing shall be as provided in the *approved* construction documents, in accordance with Section C103.2.5. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.

C104.8 Approval. After the prescribed tests and inspections indicate that the work complies in all respects with this code as described in the *approved energy analysis*, a notice of approval shall be issued by the *code official*.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

ENERGY ANALYSIS. An analysis of this code as it affects a proposed building design, using the prescriptive or performance approach in conjunction with mandatory values, that results in the required values for each energy-related material, equipment or system in the construction. The energy analysis identifies whether the design team is using the International Energy Conservation Code or ANSI/ASHRAE/IESNA Standard 90.1 for compliance and, if applicable, where trade-offs are used.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R103.2 (N1101.8) Information on construction documents. Construction documents ~~shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building systems and equipment as herein governed. Details shall include, but are not limited to, as applicable, insulation materials and their R-values; fenestration U-factors and SHGCs; area-weighted U-factor and SHGC calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with wattage and control narrative; and air sealing details.~~ required for a building permit shall include a statement by one or more registered design professionals that the project design complies with or is exempt from this code, an *energy analysis* for the building design based on the chosen compliance strategy, the design itself, utilizing the specific energy values indicated by the *energy analysis*, a commissioning plan for mechanical and electrical systems where required and a description of the progress, commissioning and final inspections and tests required by this code for the project. Electronic media documents are permitted to be submitted when approved by the *code official*.

> **Exception:** Project designs that are entirely exempt in accordance with this code are not required to provide either the *energy analysis*, supporting design documentation, commissioning plan or inspections listing required by this code.

R103.2.1 (N1101.8.1) Registered design professional statement of compliance or exemption. Construction documents submitted for a building permit shall include a statement by at least one registered design professional that the project design complies with or is exempt from this code. If the project design is exempt or partially exempt from this code, the citation shall be provided that allows the exemption.

R103.2.1.1 (N1101.8.1.1)Statements of compliance or exemption. The statement of compliance shall read as follows: "To the best of my knowledge, belief and professional judgment, all work under this application is in compliance with this code." The statement of exemption shall read as follows: "To the best of my knowledge, belief and professional judgment, all work under this application is exempt from this code in accordance with Section ___. If the proposed work is partially exempt, the registered design professional shall use the statement of compliance and note the exempted work, providing the code citation allowing the exemption.

R103.2.1.2 (N1101.8.1.2) Responsible registered design professional. If the project design team utilizes no energy trade-offs among design disciplines, each registered design professional of record may sign a statement of compliance with this code for the respective discipline. If the project design team utilizes energy trade-offs among design disciplines, at least one registered design professional shall sign the statement of compliance with this code for the entire project, including all disciplines.

R103.2.2 (N1101.8.2) Energy analysis. The construction documents shall include an *energy analysis* showing the strategy for determining project design compliance with this code, and shall indicate the specific values for each unit of material, equipment and system that such analysis indicates must be met in the completed construction. The *code official* may require that the registered design professional show the values determined by the energy analysis in a table indicating, for each material, system or equipment type, the item, its required energy value, the citation from this code and the drawing reference where the item is drawn or described.

R103.2.2.1 (N1101.8.2.1) (Prescriptive approach. If the compliance strategy uses the prescriptive approach in conjunction with the mandatory requirements, such values will be derived from provisions referenced in either Section C401.2-1 or Section C401.2-2, or from provisions referenced in Section R401.2.

R103.2.2.2 (N1101.8.2.2) Performance approach. If the compliance strategy uses the performance approach in conjunction with the mandatory requirements, such values will be derived from provisions referenced in either Section C401.2-1 or Section C401.2-3, or from provisions referenced in Section R405.

R103.2.3 (N1101.8.3) Supporting design documentation. The construction documents shall indicate materials, systems and equipment for the proposed design as identified in the *energy analysis*, and shall specify the energy values determined by the analysis. Construction documents shall be fully coordinated and of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, materials, systems and equipment as herein governed. Details shall include as applicable, but are not limited to, envelope assembly U-factors; insulation materials and their R-values; fenestration areas, U-factors and SHGCs; area-weighted U-factor and SHGC calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with input wattage, ballast type and control narrative; lighting power densities; and air sealing details for the *building thermal envelope* and penetrations through it.

R103.2.4 (N1101.8.4) Commissioning plan. Where applicable, a commissioning plan shall be provided in the construction documents in accordance with Section C408. Construction document notes shall clearly indicate provisions for commissioning and completion requirements in accordance with such section. Copies of all documentation shall be made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

R103.2.5 (N1101.8.5) Listing and description of required inspections and testing. The construction documents shall include a listing of the applicable progress, commissioning and final inspections and testing required by this code, when and how often each should be required in the project schedule, whether and what percentage of sampling will be permitted, applicable reference standards and the citation for the inspection or test.

R103.3 Examination of documents. The code official shall examine or cause to be examined the ~~accompanying~~ construction documents and shall ascertain whether the proposed construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

R104.2 Required approvals. Required inspections and testing shall be as provided in the *approved* construction documents, in accordance with Section C103.2.5. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.

R104.8 Approval. After the prescribed tests and inspections indicate that the work complies in all respects with this code as described in the *approved energy analysis*, a notice of approval shall be issued by the *code official*.

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

ENERGY ANALYSIS. An analysis of this code as it affects a proposed building design, using the prescriptive or performance approach in conjunction with mandatory values, that results in the required values for each energy-related material, equipment or system in the construction. The energy analysis identifies whether the design team is using the International Energy Conservation Code or ANSI/ASHRAE/IESNA Standard 90.1 for compliance and, if applicable, where trade-offs are used.

Reason: The text added by this proposal establishes a protocol for what is required of the registered design professional to show compliance. This protocol identifies compliance or exemption; how the energy values were derived, what code or standard is being used and whether the prescriptive or performance path is being followed; what is required in construction documents to show that the appropriate values are being specified for construction; and the commissioning and inspections program by which the construction will be inspected, tested and evaluated. In addition, it provides guidance on how to state compliance when there are trade-offs among the envelope, mechanical and electrical systems.

Cost Impact: The code change proposal will not increase the cost of construction. Registered design professionals should already be providing the information required herein in some format; this proposal articulates the compliance process and sets a standard for code officials to evaluate.

CE35-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C103.2-EC-TAYLOR.doc

CE36 – 13
C103.2

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

C103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, as applicable~~,~~:

1. Insulation materials and their *R*-values;
2. Fenestration *U*-factors and SHGCs;
3. Area-weighted *U*-factor and SHGC calculations;
4. Mechanical system design criteria;
5. Mechanical and service water heating system and equipment types, sizes and efficiencies;
6. Economizer description;
7. Equipment and systems controls;
8. Fan motor horsepower (hp) and controls;
9. Duct sealing, duct and pipe insulation and location;
10. Lighting fixture schedule with wattage and control narrative;
11. Location of *daylight zones* on floor plans; and
12. Air sealing details.

Reason: This proposal serves two purposes. First, this will help code enforcement by reformatting this section as a clear list rather than a cluttered paragraph, and also adding a requirement to show the location of daylight zones on floor plans, which will aid enforcement when daylight zones are used in sections C402.3.1-C402.3.3 (window and skylight area and properties), C405.2.2.3 (daylight controls), and C406.3 (efficient lighting path).

Second, this will encourage the architect to consider daylighting geometry earlier in the design process. While this is already good practice amongst leading architects, it is still common that by the time a lighting / daylighting designer is engaged on a project, the envelope geometry and properties have already been locked in, and are difficult and expensive to change. This change will help bring consideration of daylight zones earlier into the process.

Cost Impact: The code change proposal will not increase the cost of construction.

CE36-13

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

C103.2-EC-SANDERS.doc

CE37 – 13
C103.2.1 (NEW), R103.2.1 (NEW)

Proponent: Robby Schwarz, EnergyLogic, Inc., (robby@nrglogic.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

<u>**C103.2.1**. **Thermal envelope definition.** The building's thermal envelope shall be defined on the construction documents as the alignment of the air barrier and insulation systems separating conditioned space from unconditioned space. Where it is not possible to define the alignment of the air barrier and thermal barrier systems on the construction documents inspection shall determine success of accomplishing this requirement.</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

<u>**R103.2.1**. **Thermal envelope definition.** The building's thermal envelope shall be defined on the construction documents as the alignment of the air barrier and insulation systems separating conditioned space from unconditioned space. Where it is not possible to define the alignment of the air barrier and thermal barrier systems on the construction documents inspection shall determine success of accomplishing this requirement.</u>

Reason: The single most important energy and performance aspect of the home is the buildings thermal envelope and the alignment of the air barrier and thermal barrier systems. It is crucial that the design professional demonstrate an understanding of location of the thermal envelope and that they make an effort to draw its location so that the construction personnel can successfully implement the construction of the building in accordance with the code and the specifications that have been drawn. The air sealing details help make this possible but understanding where the details will be implemented helps ensure better implementation and enforcement.

Cost Impact: The code change proposal will not increase the cost of construction.

CE37-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C103.2.1 (NEW)-EC-SCHWARZ.doc

CE38 – 13

C103.3, C104.1, C104.2 (NEW), C104.3, C104.3.1 (NEW), C104.3.2 (NEW), C104.3.3 (NEW), C104.3.4 (NEW), C104.3.5 (NEW), C104.3.6 (NEW), C104.5, R103.3, R104.1, R104.2 (NEW), R104.3, R104.3.1 (NEW), R014.3.2 (NEW), R104.3.3 (NEW), R104.3.4 (NEW), R104.3.5 (NEW), R104.3.6 (NEW), R104.5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C103.3 Examination of documents. The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. <u>In causing the documents to be examined to verify compliance with this code, the *code official* shall be permitted to utilize a registered design professional or other *approved* entity not affiliated with the *building* design or construction in conducting the review of the plans and specifications for compliance with the code.</u>

~~**C104.1 General.** Construction or work for which a permit is required shall be subject to inspection by the *code official*.~~

<u>**C104.1 General.** Construction or work for which a permit is required shall be subject to inspection by the *code official* or his designated agent, and such construction or work shall remain accessible and exposed for inspection purposes until *approved*. Approved as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.</u>

~~**C104.2 Required approvals.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.~~

<u>**C104.2 Preliminary Inspection.** Before issuing a permit, the *code official* is authorized to examine or cause to be examined the *building site*, and in the case of work to or on an existing building the *building*, for which an application has been filed.</u>

~~**C104.3 Final inspection.** The building shall have a final inspection and not be occupied until *approved*.~~

<u>**C104.3 Required inspections.** The *code official* or his designated agent, upon notification, shall make the inspections set forth in Sections C104.3.1 through C104.3.6.</u>

C104.3.1 Footing and foundation inspection. Inspections associated with footings and foundations shall be made before backfilling and shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications for:

1. Basement or crawl space walls having insulation applied exterior to or integral with the walls
2. Slabs on grade
3. Buried duct systems associated with HVAC systems
4. Piping systems associated with HVAC or service hot water systems
5. Freeze protection/snow melt systems.

C104.3.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation, fenestration thermal properties (U-factor, SHGC and VT) and proper installation of fenestration, and air leakage controls as required by the code and approved plans and specifications for:

1. Opaque walls and wall assemblies
2. Floors and floor assemblies
3. Roof/ceilings and roof/ceiling assemblies
4. Fenestration
5. Required vestibules

C104.3.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. The R-value, location, thickness, depth of burial and protection of insulation on hot water piping
2. The existence of required temperature controls on potable hot water systems
3. The installation of automatic time switches on circulating hot water systems or heat trace
4. The installation of heat traps on hot water storage tanks associated with non-circulating systems.

C104.3.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. Installed HVAC equipment type, efficiency and size
2. Installation of gravity and motorized dampers where required and leakage rates of the dampers
3. Installation of required demand control ventilation
4. Required insulation type, R-value, thickness and proper installation of insulation for ducts, plenums and piping associated with the HVAC system
5. Sealing and any required leakage testing of ducts and plenums
6. Installation of required economizers and associated controls
7. Installation of required temperature, humidity and zone controls
8. Required sizing of HVAC system fans and motors
9. Required energy recovery capability
10. Existence of a means to balance HVAC systems
11. Installation of required controls for HVAC and hydronic systems
12. Required limitations on hot gas bypass for cooling systems
13. Installation of radiant heating systems where not allowed

C104.3.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. Proper installation of all required lighting controls
2. Installation of all lighting system components (fixtures and lamps)
3. Installation of individual electric meters for each dwelling unit in multi-family residential buildings.

C104.3.6 Final inspection. The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* controls and their proper operation as well as documentation verifying the activities associated with required *building commissioning* have been conducted and the findings of non-compliance corrected. *Buildings*, or portions thereof, shall not be considered for a final inspection until the *code official* has received a letter of transmittal from the building owner acknowledging that the building owner has received the Preliminary Commissioning Report as required in Section C408.2.4.

~~**C104.5 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

C104.5 Approved Inspection agencies. The *code official* is authorized to accept reports of third party inspection agencies not affiliated with the *building* design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R103.3 Examination of documents. The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. In causing the documents to be examined to verify compliance with this code, the *code official* shall be permitted to utilize a registered design professional or other *approved* entity not affiliated with the *building* design or construction in conducting the review of the plans and specifications for compliance with the code.

~~**R104.1 General.** Construction or work for which a permit is required shall be subject to inspection by the *code official*.~~

R104.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official* or his designated agent, and such construction or work shall remain accessible and exposed for inspection purposes until *approved*. Approved as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

~~**R104.2 Required approvals.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.~~

R104.2 Preliminary Inspection. Before issuing a permit, the *code official* is authorized to examine or cause to be examined the *building site*, and in the case of work to or on an existing building the *building*, for which an application has been filed.

~~**R104.3 Final inspection.** The building shall have a final inspection and not be occupied until *approved*.~~

R104.3 Required inspections. The *code official* or his designated agent, upon notification, shall make the inspections set forth in Sections R104.3.1 through R104.3.6.

R104.3.1 Footing and foundation inspection. Inspections associated with footings and foundations shall be made before backfilling and shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications for:

1. Basement or crawl space walls having insulation applied exterior to or integral with the walls
2. Slabs on grade
3. Buried duct systems associated with HVAC systems
4. Piping systems associated with HVAC or service hot water systems
5. Freeze protection/snow melt systems .

R104.3.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation, fenestration thermal properties (U-factor and SHGC) and proper installation of fenestration, and air leakage controls as required by the code and approved plans and specifications for:

1. Opaque walls and wall assemblies
2. Floors and floor assemblies
3. Roof/ceilings and roof/ceiling assemblies
4. Fenestration

R104.3.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. The R-value, location, thickness, depth of burial and protection of insulation on hot water piping
2. The installation of automatic or manual switches on circulating hot water systems

R104.3.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. Installed HVAC equipment type, efficiency and size
2. Installation of require programmable thermostats
3. Required heat pump supplementary heat controls
4. Installation of automatic or gravity dampers on outdoor air intakes and exhausts
5. Required insulation type, R-value, thickness and proper installation of insulation for ducts, air handlers and piping associated with the HVAC system
6. Sealing and any required leakage testing of ducts and plenums
7. Required sealing of and manufacturer's designation for air handlers
8. Required whole house ventilation and minimum fan efficacy

   Exception: Systems serving multiple dwelling units shall be inspected in accordance with Section C104.3.4.

R104.3.6 Final inspection. The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systesms, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

~~**R104.5 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

R104.5 Approved Inspection agencies. The *code official* is authorized to accept reports of third party inspection agencies not affiliated with the *building* design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.

Reason: This proposal improves and enhances the details governing inspections of construction and examination of documents associated with compliance verification.

The current provisions of Sections R 103.1 and C103.3 require the code official to examine the construction documents to verify compliance with the code. Those provisions also allow the code official to delegate that authority to another party (e.g., cause to be examined) but are not specific as to the qualifications of that party. Depending on the type and size of a residential or commercial building, the plans and specifications can be very complex and an appropriate level of review challenging for a jurisdiction that may not see many large commercial projects in a given year and/or have a unique or large residential building. Currently there is no specificity in the code about the qualifications of any third party reviewer, so the permittee could argue against the imposition of a registered design professional requirement by the jurisdiction. The proposed language makes it clear that, should the code official decide to delegate their authority to another party, such third party must be approved (a defined term in the code) by the code official; something very important because that party is acting on behalf of the code official.

The current provisions of Sections R104 and C104 covering inspections are not as specific as they could be with respect to energy efficiency. The proposed revisions to Sections R104 and C104, which are consistent with Section 109 of the International Existing Building Code (IEBC), provide the required detail to better ensure compliance with the code and through compliance delivery of the energy efficiency potential associated with the provisions of the code. It is important to point out that the provisions currently in Sections R104 and C104 are not being eliminated but instead enhanced.

- Sections R104.1 and C104.1 in the current code remain the same but have been enhanced to provide the additional detail provided in Section 109.1 of the IEBC, which is equally relevant to the IECC. In addition an allowance for the code official to have a designated agent conduct inspections has been added to recognize the ability for the code official should they so choose have a designated entity act on their behalf in conducting required inspections.
- New Sections R104.2 and C104.2 are added to the code and covers the issue of preliminary approvals. This provision appears for instance in the IEBC (109.2) and appears equally relevant to the IECC Residential and the IECC Commercial provisions.
- Sections R104.3 and C104.3 currently address a final inspection. There are, however, no provisions in the IECC that address the inspections that are necessary during the course of construction to ensure compliance with the IECC. The proposed Sections R104.3 and C104.3 include a provision for a final inspection but, as is the case in other ICC codes such as the IEBC (109), includes a number of other code-relevant inspections detailing by name what is to be assessed for compliance during key stages of construction. Having this direction, and notification to designers, builders and contractors via publication in the code, is intended to foster increased compliance with the IECC. Note also, as covered in the revisions to Sections R104.1 and C104.1, the code official can also have a designated agent conduct these inspections.
- Sections R104.5 and C104.5 as currently worded are circular in nature. They provide the code official certain authorization to accept reports from approved inspection agencies. The definition of the term approved is such that the end result of this criterion is that the code official is authorizing something based on his authority to authorize it. The proposed revisions provide the additional detail needed as to how approval of such third parties is to be addressed and the general criteria upon which they would be evaluated for acceptability.

Cost Impact: The code change proposal does not increase the cost of construction.

CE38-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C103.3-EC-WILLIAMS.doc

CE39 – 13

C104.1.1 (NEW), C104.2.1 (NEW), C104.2.2 (NEW), C104.3 (NEW), C104.3.1 (NEW), C104.4, C104.5, C104.6, C104.7, C104.8, C104.8.1, R104.1.1 (NEW), R104.2.1 (NEW), R104.2.2 (NEW), R104.3 (NEW), R104.3.1 (NEW), R104.4, R104.5, R104.6, R104.7, R104.8, R104.8.1

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C104.1.1 Approved inspection agencies. The *code official* is authorized to accept reports of *approved* inspection agencies, including *approved* commissioning agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

C104.2.1 Inspection requests. It shall be the duty of the holder of the permit or the holder's duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

C104.2.2 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.

~~**C104.3**~~ **C104.2.3 Final inspection.** The building shall have a final inspection and not be occupied until approved.

C104.3 Notice of approval. After the prescribed tests and inspections, including but not limited to applicable commissioning tests and inspections as prescribed in Section C408, indicate that work complies in all respects with this code, and required documentation, including but not limited to the final commissioning report, has been accepted by the *code official*, a notice of approval shall be issued by the *code official*.

C104.3.1 Revocation. The *code official* is authorized to suspend or revoke in writing a notice of approval issued under the provisions of this code wherever the certificate has been issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

~~**C104.4**~~ **C104.3.2 Reinspection.** A building shall be reinspected when determined necessary by the *code official*.

~~**C104.5 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

~~**C104.6 Inspection requests.** It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.~~

~~**C104.7 Reinspection and testing.** Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.~~

~~**C104.8 Approval.** After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official*.~~

~~**C104.8.1 Revocation.** The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

<u>**R104.1.1 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, including *approved* commissioning agencies, provided such agencies satisfy the requirements as to qualifications and reliability.</u>

<u>**R104.2.1 Inspection requests.** It shall be the duty of the holder of the permit or the holder's duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.</u>

<u>**R104.2.2 Reinspection and testing.** Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.</u>

~~R104.3~~ <u>R104.2.3</u> Final inspection. The building shall have a final inspection and not be occupied until approved.

<u>**R104.3 Notice of approval.** After the prescribed tests and inspections, including but not limited to applicable commissioning tests and inspections as prescribed in Section C408, indicate that work complies in all respects with this code, and required documentation, including but not limited to the final commissioning report, has been accepted by the *code official*, a notice of approval shall be issued by the *code official*.</u>

<u>**R104.3.1 Revocation.** The *code official* is authorized to suspend or revoke in writing a notice of approval issued under the provisions of this code wherever the certificate has been issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.</u>

~~R104.4~~ <u>R104.3.2</u> Reinspection. A building shall be reinspected when determined necessary by the *code official.*

~~**R104.5 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

~~**R104.6 Inspection requests.** It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.~~

~~**R104.7 Reinspection and testing.** Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official* for inspection and testing.~~

~~**R104.8 Approval.** After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official*.~~

~~**R104.8.1 Revocation.** The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.~~

Reason: The proposal better organizes this section and eliminates redundancy.

Cost Impact: The code change proposal will not increase the cost of construction.

CE39-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C104.1.1 (NEW)-EC-TAYLOR.doc

CE40 – 13

C104.3.1 (NEW), R104.3.1 (NEW)

Proponent: Hope Medina, Cherry Hills Village, representing self (hmedina@coloradocode.net)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C104.3.1 Energy Inspections. Requirements of this code shall pass inspection prior to issuance of a certificate of occupancy for the building. Inspections shall be performed by the code official or a third party approved by the code official.

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R104.3.1 Energy Inspections. Requirements of this code shall pass inspection prior to issuance of a certificate of occupancy for the building. Inspections shall be performed by the code official or a third party approved by the code official.

Reason: We are requiring for more energy efficient buildings to be built, but we do not require for any type of energy inspections to be performed. With the Federal government's energy mandates that our current building practices must increase energy conservation we are needing alter our current point of view . Section 110.3 of the IBC and section 109 of the IRC state that certain inspections are required to be done prior to obtaining a Certificate of Occupancy. Currently there are no energy code requirements listed that must be verified, but they are tied to many financial requirements, utility incentives, and local, state, and federal tax credits or incentives. There becomes a time when we can no longer over look this omission, and jump into the fire to start requiring that energy inspections be performed.

An example of a current issue is as follows. A construction services company is designing and constructing a green community affordable senior living facilities as a 2 phase project. The jurisdiction it was being built in does not perform plan reviews or inspections under the IECC. The two buildings were designed under the 2006 International Codes. With current lending requirements they were not able to obtain financing for the entire project under one loan. The project was split into two phases with two different financial loans procured. When submitting the second phase for finance they were informed that the money loaned is requiring for the building to be energy star certified. Due to the jurisdiction not performing energy plan reviews or inspections it may cost the builder it's financing or increase their budget to become compliant.

Cost Impact: This code change will not increase the cost of construction.

CE40-13

PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C109.1.5-EC-MEDINA.doc

CE41 – 13

C104.5, C104.5.1 (NEW), C202 (NEW), R104.5, R104.5.1 (NEW), R202 (NEW) (IRC N1101.9 (NEW))

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C104.5 Approved ~~inspection~~ agencies. The *code official* ~~is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~ or other authority having jurisdiction shall be permitted to designate an *approved agency* to determine compliance with any, some or all requirements of this code. Such *approved agency* shall:

1. Administer all necessary tests, review all relevant construction documents, and conduct all required inspections related to any code requirement where such agency is providing certification of compliance.
2. Produce a written report addressing all tests, inspections, review and analysis conducted and certifying compliance with such specific requirements of this code.

C104.5.1 Standard for approved agencies. An *approved agency* shall be *approved* after the *code official* or other authority having jurisdiction has determined that the agency meets the applicable requirements. An *approved agency* shall provide all of the information necessary to make such a determination. An *approved agency* shall:

1. Be objective, competent and independent from all interested parties, including all contractors responsible for the work being inspected, and disclose possible conflicts of interest so that objectivity can be confirmed.
2. Have adequate equipment to perform any required test or inspections.
3. Employ experienced personnel educated and qualified to conduct the necessary review, tests, inspections and other actions to determine compliance.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been *approved*.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R104.5 Approved ~~inspection~~ agencies. The *code official* ~~is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

or other authority having jurisdiction shall be permitted to designate an *approved agency* to determine compliance with any, some or all requirements of this code. Such *approved agency* shall:

1. Administer all necessary tests, review all relevant construction documents, and conduct all required inspections related to any code requirement where such agency is providing certification of compliance.
2. Produce a written report addressing all tests, inspections, review and analysis conducted and certifying compliance with such specific requirements of this code.

R104.5.1 Standard for approved agencies. An *approved agency* shall be *approved* after the *code official* or other authority having jurisdiction has determined that the agency meets the applicable requirements. An *approved agency* shall provide all of the information necessary to make such a determination. An *approved agency* shall:

1. Be objective, competent and independent from all interested parties, including all contractors responsible for the work being inspected, and disclose possible conflicts of interest so that objectivity can be confirmed.
2. Have adequate equipment to perform any required test or inspections.
3. Employ experienced personnel educated and qualified to conduct the necessary review, tests, inspections and other actions to determine compliance.

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been *approved*.

Reason: The purpose of the proposed code change is to establish new requirements for *approved agencies* and to otherwise clarify the code -- this proposal will improve the potential for approved agencies to assist in code compliance and enforcement efforts. The proposal imports the definition of “approved agency” from the 2012 *IBC* into the *IECC*, clarifies the role of approved agencies in verifying aspects of energy code compliance and establishes standards for such agencies to be approved. The IECC currently does not give enough direction about the role of such approved agencies or the minimum requirements for these entities. This proposal improves the code by outlining the requirements for approved agencies, including:

- Third-party administration of the verification activities
- Quality and reliability of the approved agency
- Written reports of code compliance

These requirements are all common-sense and already may be employed by jurisdictions that delegate testing or inspection authority to third parties. We believe that it makes sense to include these requirements in the IECC so that jurisdictions can apply more uniform criteria to approved agencies, and so that third parties can better tailor their compliance and enforcement programs to meet the expectations of the state or locality.

Cost Impact: The code change proposal will not increase the cost of construction.

Note: The term ‘approved agency’ is defined in other International Codes including IBC, IRC, IMC, IPC and IgCC. The definition proposed here is the same as that found in these other code.

CE41-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C104.5-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE42 – 13
C106.1.2, C106.2

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

Revise as follows:

C106.1.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

> **Exception.** Where using ANSI/ASHRAE/IESNA 90.1 as a compliance path as allowed in Section C401.2 Item 1 or Section C401.2.1 Item 2.

~~**C106.2 Conflicting requirements.** Where the provisions of this code and the referenced standards conflict, the provisions of this code shall take precedence.~~

Reason: Adding the exception to C106.1.2 clarifies the intent in Section C401.2 that commercial buildings shall comply with either ANSI/ASHRAE/IESNA 90.1in its entirety or the requirements of the IECC Sections in its entirety.

Section C106.2 is unnecessary as it simply restates the requirements in C106.1.1 and C106.1.2 and adds confusion in which section to cite.

Cost Impact: The code change proposal will not increase the cost of construction.

CE42-13

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

C106.1.2-EC-ELLIS.doc

CE43 – 13
C106.2, R106.2

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C106.2 Conflicting requirements.** Where the provisions of this code and the referenced standards conflict, the provisions of this code shall take precedence.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Delete without substitution as follows:

~~**R106.2 Conflicting requirements.** Where the provisions of this code and the referenced standards conflict, the provisions of this code shall take precedence.~~

Reason: Section C106.2 is redundant of Section C106.1.1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE43-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C106.2-EC-TAYLOR.doc

CE44 – 13
C108.4, R108.4

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C108.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine ~~of not less than {AMOUNT] dollars or more than [AMOUNT} dollars~~.<u>as set by the applicable governing authority</u>.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R108.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine ~~of not less than {AMOUNT] dollars or more than [AMOUNT} dollars~~.<u>as set by the applicable governing authority</u>.

Reason: Codes are adopted in various ways by varying entities, federal agencies, states, counties, or municipalities. Often one level of government will adopt the code, while the enforcement is at a different level. Some of the adopting entities do not have the means to insert a specific fine amount, in some instances the enforcement may be by several entities that have fine amounts that vary and in some cases the fine amount may unknown to the adopting agency.

This proposal will also eliminate the need to amend the code ordinance when the fine structure is revised.
This change allows the code to be adopted without relying on the amount to be determined at the time of adoption.

Cost Impact: The code change proposal will not increase the cost of construction.

CE44-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C108.4-EC-ELLIS.doc

CE45 – 13
C202

Proponent: Shaunna Mozingo, City of Cherry Hills Village, representing Colorado Chapter of ICC, Inc (smozingo@coloradocode.net)

Revise as follows:

SECTION C202
GENERAL DEFINITIONS

ABOVE-GRADE WALL. A wall more than ~~50~~ 15 percent above grade ~~and enclosing *conditioned space*~~. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

BASEMENT WALL. A wall ~~50~~ 85 percent or more below grade ~~and enclosing *conditioned space*~~.

Reason: These original definitions actually belonged only in the residential portion of the Energy Code. Sections C402.2.2.1 and 402.2.2.2 clarify that for a commercial building an above grade wall is 15% or more above grade and below grade walls are 85% or more below grade. There is a big difference between the 50% and the 15% for above grade walls as well as the 50% and the 85% for below grade walls. It shouldn't matter if the space is conditioned or not, the requirements will apply differently to those walls depending on the conditioning but the definition shouldn't call out an above or below grade wall based on whether it is conditioned or not. The existing definitions came over from the residential code and were always in the definition section of the IECC, making it seem like they applied to both residential and commercial but in fact the afore mentioned commercial wall clarifications have always been in Chapter 5 of the IECC, making the definition in Chapter 2 a matter of confusion for the code user.

When the IECC was split up and new chapters 1-3 were created for both the residential and the commercial portions of the code some things were brought over into the commercial chapters that belonged only to residential and vice versa. It becomes necessary now to clean up these very separate and distinct chapters so that those who may be new to the energy code and were not aware of the previous combined versions of chapters 1-3 will not be confused by things that were brought forward by mistake.

Cost Impact: This code change proposal will not increase the cost of construction.

CE45-13

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

C202-ABOVE GRADE WALL-EC-MOZINGO.doc

CE46 – 13
C202, R202 (IRC N1101.9)

Proponent: Robby Schwarz, EnergyLogic, Inc., (robby@nrglogic.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

Part I – IECC - COMMERICAL

Revise definition as follows:

SECTION C202
GENERAL DEFINITIONS

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope between conditioned space and unconditioned space, including necessary sealing to block air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. An air barrier may be a single material or a combination of materials that are in continuous alignment throughout the 3D structure of the air barrier and the thermal barrier of the building. The air barrier system is constructed of materials that are impermeable to the movement of air and are strong and durable to perform throughout the serviceable life of the building. An interior and exterior continuous air barrier system is utilized and installed in alignment with all fibrous cavity insulation systems. i.e. six sided encapsulation is walls and floor systems.

Part II – IECC - RESIDENTIAL

Revise definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope between conditioned space and unconditioned space, including necessary sealing to block air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. An air barrier may be a single material or a combination of materials that are in continuous alignment throughout the 3D structure of the air barrier and the thermal barrier of the building. The air barrier system is constructed of materials that are impermeable to the movement of air and are strong and durable to perform throughout the serviceable life of the building. An interior and exterior continuous air barrier system is utilized and installed in alignment with all fibrous cavity insulation systems. i.e. six sided encapsulation is walls and floor systems.

Reason: The air barrier system is a crucial element of the buildings structure in creation of efficient homes. If they it is not clearly defined then identification, implementation, and enforcement of the energy code will continue to be ambiguous. The language here is intended clarify what is meant by the term so that implementation and enforcement of the code is less ambiguous.

Cost Impact: This code change proposal will not increase the cost of construction.

CE46-13
Part I – IECC – COMMERICAL PROVISIONS

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

Part II – IECC – RESIDENTIAL PROVISIONS

Public Hearing:	Committee:	AS	AM	D

Assembly: ASF AMF DF

CE47 – 13
C202, R202 (IRC N1101.9), IRC 202

Proponent: Ellen Eggerton, representing Virginia Building and Code Officials Association

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART III WILL BE HEARD BY THE IRC BUILDING CODE DEVELOPMENT COMMITTEE.

PART I - IECC – COMMERCIAL PROVISIONS

Revise definition as follows:

SECTION C202
GENERAL DEFINITIONS

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space. <u>An unconditioned space shall include those buildings or spaces, adjacent to a *conditioned space*, that are not heated or cooled due to periods of non-occupancy, such as an adjacent townhouse.</u>

PART II - IECC – RESIDENTIAL PROVISIONS

Revise definition as follows:

SECTION R202
GENERAL DEFINITIONS

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space. <u>An unconditioned space shall include those buildings or spaces, adjacent to a *conditioned space*, that are not heated or cooled due to periods of non-occupancy, such as an adjacent townhouse.</u>

PART III – IRC

Revise definition as follows:

SECTION 202
GENERAL DEFINITIONS

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space. <u>An unconditioned space shall include those buildings or spaces, adjacent to a *conditioned space*, that are not heated or cooled due to periods of non-occupancy, such as an adjacent townhouse.</u>

Reason: The proposed change is intended to ensure that the thermal envelope boundary will include the separation between a conditioned space and those spaces which have a reasonable expectation of being unoccupied (and therefore unconditioned) for a significant albeit temporary period of time. Typical residential building example is an occupied townhouse that is adjacent to an unoccupied townhouse. If the common wall between the townhouses is uninsulated, there will be unnecessary heat transfer across that boundary. The proposal will prevent this situation from developing.

Cost Impact: There may be cost impacts of this proposal, but they are difficult to gage. Townhouses required "rated" separations which may include insulating materials that could also satisfy the wall R-value requirement. Common townhouse construction practice is to build a stud wall on the inside of the rated wall, which could be filled with materials with the required R-value.

CE47-13

PART I – IECC – COMMERICAL PROVISIONS

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

PART II – IECC – RESIDENTIAL PROVISIONS

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

PART III – IRC

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

C202-BUILDING THERMAL ENVELOPE-EC-EGGERTON.doc

CE48 – 13
C202, R202 (IRC N1101.9), IRC R202

Proponent: Robby Schwarz, EnergyLogic, Inc., (robby@nrglogic.com)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART III WILL BE HEARD BY THE IRC BUILDING CODE DEVELOPMENT COMMITTEE.

PART I - IECC – COMMERCIAL PROVISIONS

Revise definition as follows:

SECTION C202
GENERAL DEFINITIONS

BUILDING THERMAL ENVELOPE. The continuous alignment of the air barrier and thermal barrier in basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

PART II - IECC – RESIDENTIAL PROVISIONS

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

Revise definition as follows:

BUILDING THERMAL ENVELOPE. The continuous alignment of the air barrier and thermal barrier in basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

PART III – IRC

Revise definition as follows:

SECTION 202
GENERAL DEFINITIONS

BUILDING THERMAL ENVELOPE. The continuous alignment of the air barrier and thermal barrier in basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

Reason: The thermal envelope is a crucial elements of the buildings structure in creation of efficient homes. If it not clearly defined then identification of the thermal boundary and implementation and enforcement of the energy code will continue to be ambiguous. The language here is intended to clarify what is meant by the term so that implementation and enforcement of the code is less ambiguous.

Cost Impact: This code change proposal will not increase the cost of construction.

CE48-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

PART III – IRC

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

R202-BUILDING THERMAL ENVELOPE-EC-SCHWARZ.doc

CE49–13
C202 (NEW), R202 (NEW) (IRC N1101.9 (NEW)), IPC 202 (NEW)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE IECC COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS 2 SEPARATE CODE CHANGES. PART III WILL BE HEARD BY THE IECC RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Greg Towsley, LEED AP BD+C Grundfos representing Grundfos (gtowsley@grundfos.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

PART II – IPC

Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

PART III – IECC-RESIDENTIAL PROVISIONS

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

Reason: A definition of a “circulating hot water system” does not exist in the code, yet it is referenced in the IRC and other ICC codes. This definition brings clarity to how a “circulating hot water system” should be designed and operated. In the codes and sections where “circulating hot water system” is used, this definition would also reduce the probability of confusion between hot water systems used for space heating or tempered water. Currently, the only place that the term CIRCULATING HOT WATER SYSTEM shows up in the code is IECC Section C404.6, IPC [E] 607.2.1 and IECC Section R403.4.1 (IRC N1103.4.1). Other proposals by other proponents will most likely be adding language that uses this term so it is important to have the term defined.

As referenced in CHAPTER 50 - SERVICE WATER HEATING of *ASHRAE Handbook-HVAC Applications* (2011, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.), “Some recirculation-loop systems...are equipped with circulating pumps to force water through the piping and back to the water heater, thus keeping water in the piping hot.” Adding this definition in the code will be consistent with industry’s understanding.

Cost Impact: The code change proposal will not increase the cost of construction.

CE49-13
PART I – IECC-COMMERCIAL PROVISIONS

Public Hearing: Committee: AS AM D

	Assembly:	ASF	AMF	DF

PART II– IPC

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

PART III – IECC-RESIDENTIAL PROVISIONS

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

C202-CIRCULATING HOT WATER SYSTEM (NEW)-EC-TOWLSEY.doc

CE50 – 13
C202 (NEW), R202 (NEW) (IRC N1101.9 (NEW)), IRC 202 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE, PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART III WILL BE HEARD BY THE IRC BUILDING CODE DEVELOPMENT COMMITTEE.

PART I – IECC – COMMERICAL PROVISIONS

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in this code.

PART II – IECC – RESIDENTIAL PROVISIONS

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in this code.

PART III – IRC

Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in this code.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:

There are increasing numbers of proposals in which the term 'climate zone' is used in the proposed code text. This has primarily occurred in the *International Building Code* and the *International Green Construction Code*. In 2012 at least 8 proposals heard in Dallas included the term. The Code Development Committees generally tried to make sure that each approved action included that it was Climate Zones as established in the IECC.

The SEHPCAC submitted public comments to G147-12 and G149-12 to remove individual references in the text of the IBC stating that Climate Zones 'as established in the IECC' and proposed the inclusion in Chapter 2 of the IBC the following definition of Climate Zone.

CLIMATE ZONE. A geographic region that have been assigned climatic criteria as specified in Chapters 3CE and 3RE of the *International Energy Conservation Code.*

The public comments were approved by the membership and the definition is established in the IBC.

The proposed definition for the IECC is a further simplification of the version in the IBC as the extended reference isn't needed. The SEHPCAC reviewed the other codes which are part of Group B. Only the International Residential Code uses the term Climate Zone. This is addressed in Part III of this proposal. The intent of the public comments to the IBC was to simplify the reference each time Climate Zone is used to those zones 'defined' in the IECC. The issue is that 'Climate Zones' are established in the IECC, but there is no definition.

In Cycle C, the SEHPCAC will submit a code change to the IgCC to add a definition of Climate Zone. This will allow all future references to Climate Zone to be simple and not have to say “as established in the International Energy Conservation Code.

Cost Impact: This code change proposal will not increase the cost of construction.

CE50-13
PART I – IECC – COMMERCIAL PROVISIONS

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

PART II – IECC – RESIDENTIAL PROVISIONS

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

PART III – IRC

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

C202-CLIMATE ZONE-EC-THOMPSON-SEHPCAC.doc

CE51 – 13
C202, R202 (IRC N1101.9)

Proponent: Shaunna Mozingo, City of Cherry Hills Village, representing Colorado Chapter of ICC, Inc (smozingo@coloradocode.net), Brent Ursenbach, Salt Lake County, representing Utah Chapter ICC and Utah Association of Plumbing and Mechanical Officials Chapter ICC (bursenbach@slco.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC – COMMERICAL PROVISIONS

Delete and substitute as follows:

SECTION C202
GENERAL DEFINITIONS

~~**CONDITIONED SPACE.** An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*.~~

<u>**CONDITIONED SPACE**. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate thru openings with conditioned spaces, where they are separated from conditioned spaces by un-insulated walls, floors or ceilings, or where they contain un-insulated ducts, piping or other sources of heating or cooling.</u>

PART II – IECC RESIDENTIAL PROVISIONS

Delete and substitute as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

~~**CONDITIONED SPACE.** For energy purposes, space within a building that is provided with heating and/or cooling *equipment* or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with a *conditioned space*. For mechanical purposes, an area, room or space being heated or cooled by any *equipment* or *appliance*.~~

<u>**CONDITIONED SPACE**. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate thru openings with conditioned spaces, where they are separated from conditioned spaces by un-insulated walls, floors or ceilings, or where they contain un-insulated ducts, piping or other sources of heating or cooling.</u>

Reason: (Mozingo) Currently the definition for conditioned space differs in each code. The proposed change to the definition would bring the IECC and IRC in line with what was approved in Group A for the 2015 IMC as proposal M2-12. This proposal shows the modifications that were made by the committee and then went on to the consent agenda as there were no public comments received. This proposed change is similar to the definition in ASHRAE 90.1 – 2010.
(Ursenbach) (**Part I)** Confusion exists between the definitions in the IMC, IRC and IECC. The IECC attempts to define how a space may be indirectly conditioned; however, further clarification is needed. The definition for conditioned space as proposed above is the definition approved in the Group A hearings for the IMC under M2-12. This proposed change is similar to the definition in ASHRAE 90.1 – 2010. **(Part II)** Confusion exists between the definitions in the IMC, IRC and IECC. The IECC attempts to define how a space may be indirectly conditioned; however, further clarification is needed. The definition for conditioned space as proposed above is the definition approved for the IMC in the Group A hearings under M2-12. This proposed change is similar to the definition in ASHRAE 90.1 – 2010.

Cost Impact: This code change proposal will not increase the cost of construction.

CE51-13
PART I – IECC- COMMERICAL PROVISIONS

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

PART II – IECC- RESIDENTIAL PROVISIONS

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

C202-CONDITIONED SPACE-EC-MOZINGO-URSENBACH.doc

CE52 – 13
C202 (NEW), R202 (NEW) (IRC N1101.9 (NEW))

Proponent: Jay Crandell, ARES Consulting, representing American Chemistry Council- Foam Sheathing Committee (jcrandell@aresconsulting.biz Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (Eric@BrittMakela.com), Steve Ferguson, ASHRAE (sferguson@ashrae.org), Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC – COMMERICAL PROVISIONS

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**CONTINUOUS INSULATION (ci):** Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.</u>

PART II – IECC – RESIDENTIAL PROVISIONS

Add new definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

<u>**CONTINUOUS INSULATION (ci):** Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.</u>

Reason: (Crandell) This proposal provides a needed definition for continuous insulation (a term presently used in the IRC and IECC). The proposed definition is from the 2010 edition of ASHRAE 90.1 and provides an effective definition that is inclusive of all types of continuous insulation materials, including spray foam, insulated siding, foam sheathing, and others.
(Makela) The term continuous insulation was introduced to the commercial provisions of the IECC in 2006. Unfortunately, the term has never been defined in the code. Since its introduction into the code, questions have arisen concerning what is and is not considered continuous insulation. For example, if furring strips are installed on a mass wall and insulation is installed between the furring strips over the face of the wall, is this considered continuous insulation or insulation installed in the cavity? This proposal provides a reasonable definition for continuous insulation that doesn't prohibit different types of materials from being used. The definition uses the term "Insulating material" which can be a variety of products including wood. The R-value requirements for walls in Table C402.2 provides the minimum R-values for the insulating material and as long at as the material can be demonstrated to meet the minimum R-value it can be considered an insulating material. The key to maintaining the effectiveness of continuous insulation is to reduce or eliminate thermal bridging, which this definition achieves.
(Ferguson) In table C402.2, the term continuous insulation has been added, though it is undefined. This adds a definition for the term which is identical to the already existing definition in ANSI/ASHRAE/IES Standard 90.1-2010
(Weston) This proposal adds a definition for continuous insulation. Continuous insulation is used within the code, but the definition is missing. The proposed definition is consistent with that in ASHRAE 90.1

Cost Impact: This code change proposal will not increase the cost of construction.

CE52-13
PART I – IECC-COMMERICAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C202-CONTINUOUS INSULATION (ci) (NEW)-EC-CRANDELL-MAKELA-FERGUSON-WESTON.doc

CE53 – 13
C202

Proponent: Tim Manz, City of Blaine, MN, representing Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Revise definition as follows:

SECTION C202
GENERAL DEFINITIONS

INFILTRATION. The uncontrolled inward air leakage into a building caused by the pressure effects of wind ~~or~~ , The effect of differences in the indoor and outdoor air density ~~or both~~, or imbalance between supply and exhaust air systems.

Reason: The imbalance between supply and exhaust air systems can be a major contributor to air infiltration into a building. The reason for this proposed code change is to include this imbalance as a part of the definition, which is already contained in the definitions in the current Minnesota Commercial Energy Code that adopts ASHRAE Standard 90.1-2004.

Cost Impact: This code change proposal will not increase the cost of construction.

CE53-13

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

C202-INFILTRATION-EC-MANZ.doc

CE54 – 13
C202 (New)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

LINER SYSTEM (Ls). A continuous vapor barrier liner membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the liner membrane between the purlins. For multilayer installations, the last *rated R-value of insulation* is for unfaced insulation draped over purlins and then compressed when the metal roof panels are attached.

FILLED CAVITY (FC). The first *rated R-value of insulation* represents faced or unfaced insulation installed between the purlins. The second *rated R-value of insulation* represents unfaced insulation installed above the first layer, perpendicular to the purlins and compressed when the metal roof panels are attached. A supporting structure retains the bottom of the first layer at the prescribed depth required for the full thickness of insulation.

Reason: Liner systems and filled cavity metal building roof assemblies can be used for compliance with the Opaque assembles in table C402.2. This adds definitions for the terms, which are identical to the already existing definition in ANSI/ASHRAE/IES Standard 90.1-2010

Cost Impact: The code change proposal will not increase the cost of construction.

CE54-13

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

C202-LINEAR SYSTEM (Ls) (NEW)-EC-FERGUSON.doc

CE55 – 13
C202 (New)

Proponent: Steve Ferguson, ASHRAE (sferguson@ashrae.org), Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**POWERED ROOF/WALL VENTILATORS.** A fan consisting of a centrifugal or axial impeller with an integral driver in a weather-resistant housing and with a base designed to fit, usually by means of a curb, over a wall or roof opening.</u>

Reason: This is a companion proposal to the Fan Efficiency Grade (FEG) proposal submitted by AMCA International. Adding this definition for powered roof/wall ventilators to the code will help to clarify this term, which occurs in the list of proposed exceptions to the FEG proposal.

The language was taken from ANSI/AMCA Standard 99-10 *Standards Handbook*, and identical language was used in the ASHRAE 90.1-2010 Addendum u, which added a fan efficiency requirement and which is expected to be in the 2013 version of the Standard.

It is only relevant IF the FEG proposal is approved for addition into the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE55-13

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

C202-POWERED ROOF-WALL VENTILATORS-EC-FERGUSON-HICKMAN.doc

CE56 – 13
C202 (NEW)

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**REROOFING.** The process of recovering or replacing an existing roof covering.</u>

<u>**ROOF RECOVER.** The process of installing an additional roof covering over an existing roof covering without removing the existing roof covering.</u>

<u>**ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purpose of its maintenance.</u>

<u>**ROOF REPLACMENT.** The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.</u>

Reason: This code change proposal is intended to clarify the Code's intent by defining specific roofing-related terms.

The term "reroofing" is not currently defined in the I-codes. The definition proposed here is taken form IBC Section 1510-Reroofing.

The terms and definitions for "roof recover", "roof repair" and "roof replacement" are taken from IBC Section 202-Defintions and are consistent with those understood by the roofing industry.

Cost Impact: The code change proposal will not increase the cost of construction.

CE56-13

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

C202-REROOFING (NEW)-EC-GRAHAM.doc

CE57 – 13
C202 (NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

ROOFTOP MONITOR. A raised section of a roof containing vertical fenestration along one or more sides.

Reason: There is currently no definition of rooftop monitor, yet the term is used in Section C402.3.2.1 (4). This proposal provides a definition of the term "Rooftop Monitor" as used in Section C402.3.2.1 (4). A definition of rooftop monitor is needed to clarify the intent and ensure uniform application of the exception.

Cost Impact: This code change proposal will not increase the cost of construction.

CE57-13

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

C202-ROOFTOP MONITOR (NEW)-EC-WILLIAMS.doc

CE58 – 13
C202, R202 (IRC N1101.9)

Proponent: Jeff Inks, Window & Door Manufacturers Association (jinks@wdma.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC – COMMERCIAL PROVISIONS

Revise definition as follows:

SECTION C202
GENERAL DEFINITIONS

SKYLIGHT AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of ~~less than 60 degrees (1.05 rad) from horizontal~~ 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, tubular daylighting devices, solariums, sunrooms, roofs and sloped walls is included in this definition.

PART II – IECC – RESIDENTIAL PROVISIONS

SECTION R202
GENERAL DEFINITIONS

Revise definition as follows:

SKYLIGHT AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of ~~less than 60 degrees (1.05 rad) from horizontal~~ 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, tubular daylighting devices, solariums, sunrooms, roofs and sloped walls is included in this definition.

Reason: The definitions for skylights and sloped glazing were amended during the last code cycle to align with the definitions in ASHRAE 90.1 and not because of technical substantiation with respect to improvements in energy efficiency justifying the change. The definitions now conflict with the definitions for skylights and sloped glazing in the IBC and IRC. Given the IECC is an I-code and should there include definitions that are consistent with other I-codes, and that the alignment with ASHRAE 90.1 was not based on technical substantiation with respect to improvements in energy efficiency, the definitions for skylights and sloped glazing should be consistent with the definitions for them in the IBC and IRC. This proposal corrects that inconsistency.

Cost Impact: This code change proposal will not increase the cost of construction.

CE58-13
PART I – IECC – COMMERCIAL PROVISIONS

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

PART II – IECC – RESIDENTIALPROVISIONS

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

C202-SKYLIGHT-EC-INKS.doc

CE59 – 13
C202, R202 (IRC N1101.9)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

SECTION C202
GENERAL DEFINITIONS

Revise definitions as follows:

~~**FENESTRATION**~~ <u>**VERTICAL FENESTRATION.**</u> ~~Skylights, roof windows, vertical~~ ~~w~~ <u>W</u>indows (fixed or movable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors <u>composed of</u>~~.~~ ~~Fenestration includes products with~~ glass ~~and~~ ~~nonglass~~ <u>or other transparent or translucent</u> glazing materials <u>and installed at a slope of at least 60 degrees from horizontal</u>.

~~**SKYLIGHT**~~ <u>**SKYLIGHT**</u>. Glass or other transparent or translucent glazing material installed with a slope of less than 60 degrees (1.05 rad) from horizontal. ~~Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise definitions as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

~~**FENESTRATION.**~~ <u>**VERTICAL FENESTRATION.**</u> ~~Skylights, roof windows, vertical~~ ~~w~~ <u>W</u>indows (fixed or movable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors <u>composed of</u>~~.~~ ~~Fenestration includes products with~~ glass ~~and~~ ~~nonglass~~ <u>or other transparent or translucent</u> glazing materials <u>and installed at a slope of at least 60 degrees</u> (1.05 rad) <u>from horizontal</u>.

~~**SKYLIGHT**~~ <u>**SKYLIGHT.**</u> Glass or other transparent or translucent glazing material installed with a slope of less than 60 degrees from horizontal. ~~Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.~~

Reason: The code currently has no thermal provisions (U-factor or SHGC) for any fenestration material or product installed at an angle of greater than 0 up to and including 30 degrees from vertical. This proposal clarifies the application of thermal provisions (U-factor or SHGC) for fenestration materials or products installed at an angle greater than 0 up to and including 30 degrees from vertical.

There are a number of commercial and residential building designs in which sloped glazing is used, and as such is clearly not vertical but in addition does not meet the greater than 30 degrees from vertical (at least 60 degrees from horizontal) criterion to consider it a skylight. While it may be inferred that vertical fenestration is intended to include all fenestration other than skylights, technically the code does not apply to the fenestration in question. Vertical fenestration is used in Sections C402.3.1, C402.3.1.1, C402.3.3, C402.3.3.1, C402.3.3.2, R402.5 and Table C402.3. This loophole needs to be corrected and rather than change the term in the code from vertical fenestration to some other term, it is considered more appropriate to define what is intended when using the term "vertical fenestration" even though it is not truly vertical. Another change makes it clear that fenestration can be either glass **or** nonglass glazing materials and does not need to include both glass **and** nonglass glazing materials. The last sentence in the current definition of skylight can be deleted because the terms for the products are added to the previous sentence and it is not necessary to indicate the location of the skylights as they will always be in a roof or wall assembly. The focus of both definitions is simply the angle of the fenestration as installed.

Cost Impact: This code change proposal will not increase the cost of construction.

Note: The IBC, IRC and the igCC have two defined terms related to skylights. They are 'skylights and sloped glazing' and 'skylight unit' as follows

> **SKYLIGHT, UNIT.** A factory-assembled, glazed fenestration unit, containing one panel of glazing material that allows for natural lighting through and opening in the roof assembly while preserving the weather-resistant barrier of the roof.
> **SKYLIGHTS AND SLOPED GLAZING.** Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing materials in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls, are included in this definition.

CE59-13
PART I – IECC-COMMERCIAL PROVISIONS

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

Part II – IECC-RESIDENTIAL PROVISIONS

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

C202-FENESTRATION-EC-WILLIAMS.doc

CE60 – 13
C301, C301.1, Figure C301.1, Table C301.1, C301.2, C301.3

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Delete and substitute as follows:

~~**SECTION C301**~~
~~**CLIMATE ZONES**~~

~~**C301.1 General.** Climate zones from Figure C301.1 or Table C301.1 shall be used in determining the applicable requirements from Chapter 4. Locations not in Table C301.1 (outside the United States) shall be assigned a climate zone based on Section C301.3.~~

~~**FIGURE C301.1**~~
~~**CLIMATE ZONES**~~

~~**TABLE C301.1**~~
~~**CLIMATE ZONES, MOISTURE REGIMES, AND WARM HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY**~~

~~**C301.2 Warm humid counties.** Warm humid counties are identified in Table C301.1 by an asterisk.~~

~~**C301.3 International climate zones.** The climate zone for any location outside the United States shall be determined by applying Table C301.3(1) and then Table C301.3(2).~~

~~**TABLE C301.3(1)**~~
~~**INTERNATIONAL CLIMATE ZONE DEFINITIONS**~~

~~**TABLE C301.3(2)**~~
~~**INTERNATIONAL CLIMATE ZONE DEFINITIONS**~~

C301
CLIMATE ZONES

C301.1 Climates zones shall be as specified in Section R301.

Reason: If multiple climate zone maps are retained within the I-codes, these maps may diverge over time. It is best to have one climate zone map that all use for the I-codes.

Cost Impact: The code change proposal will not increase the cost of construction.

CE60-13

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

C301 (NEW)-EC-CONNER.doc

CE61 – 13
Table C301.1, Table R301.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

TABLE C301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

COLORADO
5B Adams
6B Alamosa
5B Arapahoe
6B Archuleta
4B Baca
5B Bent
5B Boulder
5B Broomfield
6B Chaffee

(Portions of Table not shown remain unchanged)

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

TABLE R301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

COLORADO
5B Adams
6B Alamosa
5B Arapahoe
6B Archuleta
4B Baca
5B Bent
5B Boulder
5B Broomfield
6B Chaffee

(Portions of Table not shown remain unchanged)

Reason: Broomfield County is a consolidated city-county and a suburb of Denver. Constituted on November 15, 2001, it was apparently missing from the county database(s) used to establish the IECC's county-zone mappings. See http://en.wikipedia.org/wiki/Broomfield, Colorado.

Cost Impact: The code change proposal will not increase the cost of construction.

CE61-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C301.1T-EC-WILLIAMS.doc

CE62 – 13

Figure C301.1, Table C301.1, Figure R301.1 (IRC Figure N1101.10), Table R301.1 (IRC Table N1101.10)

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows: End the Warm-Humid white line at the line separating the Dry (B) and Moist (A) moisture zones.

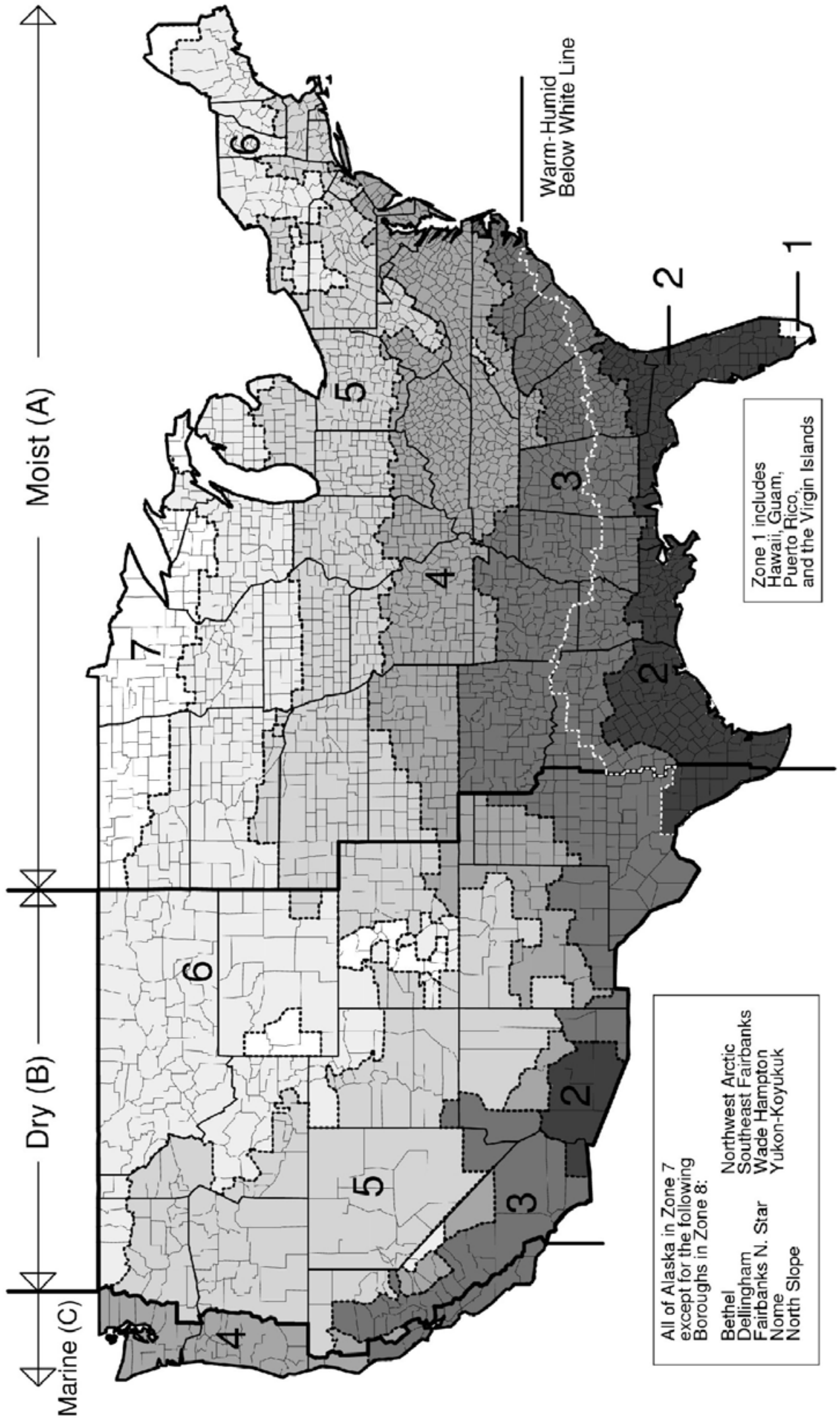

Marine (C)
Dry (B)
Moist (A)
Warm-Humid
Below White Line
Zone 1 includes
Hawaii, Guam,
Puerto Rico,
and the Virgin Islands
All of Alaska in Zone 7
except for the following
Boroughs in Zone 8:
Bethel
Dellingham
Fairbanks N. Star
Nome
North Slope
Northwest Arctic
Southeast Fairbanks
Wade Hampton
Yukon-Koyukuk
1
2
3
4
5
6
7

FIGURE C301.1
CLIMATE ZONES

Revise as follows: Remove the asterisk (*) from the following Counties, thereby removing the warm-humid location designation.

TABLE C301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

TEXAS

Bandera*
Dimmit*
Edwards*
Frio*
Kinney*
La Salle*
Maverick*
Medina*
Real*
Uvalde*
Val Verde*
Webb*
Zapata*
Zavala*

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows: End the Warm-Humid white line at the line separating the Dry (B) and Moist (A) moisture zones.

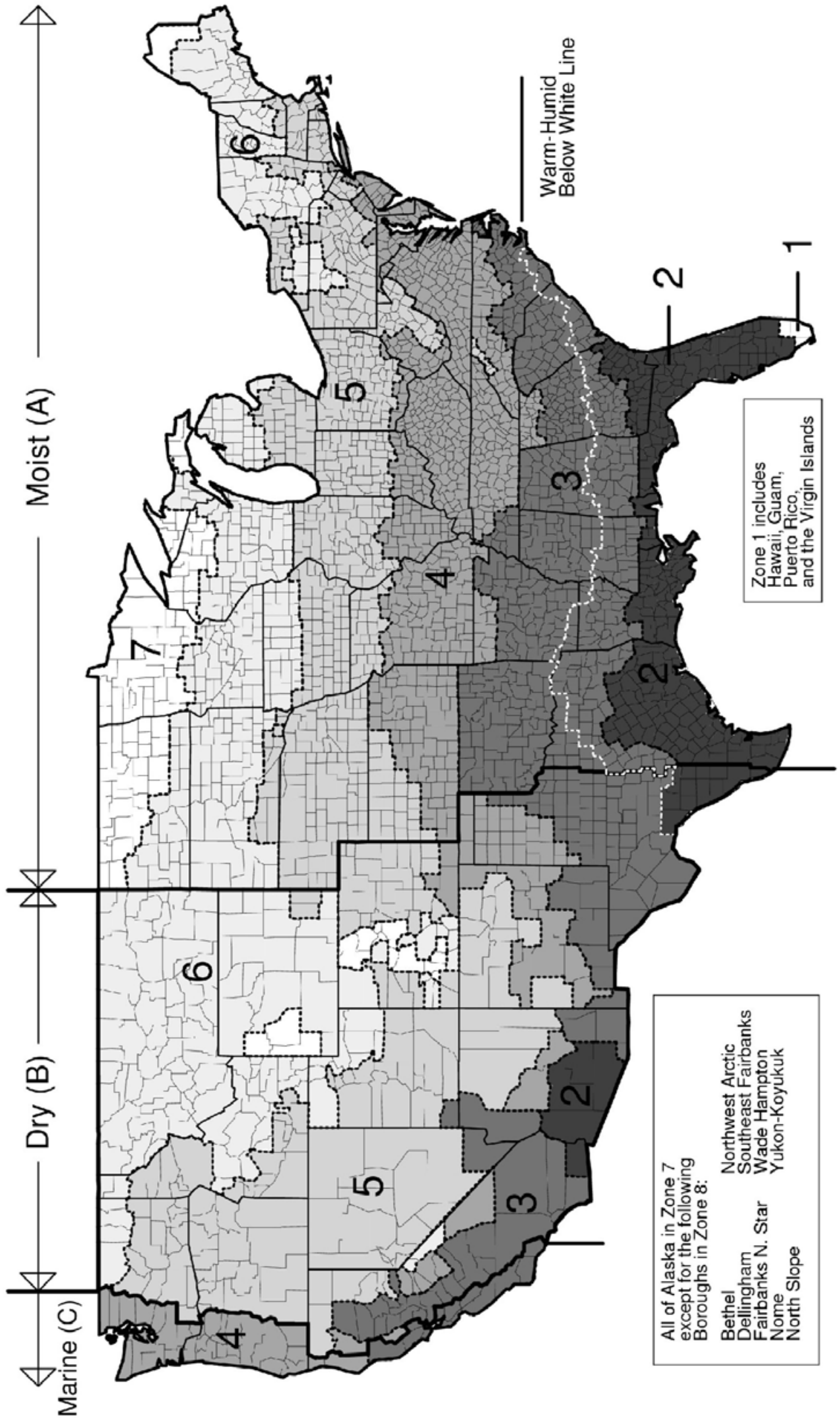


FIGURE R301.1 (N1101.10)
CLIMATE ZONES

Revise as follows: Remove the asterisk (*) from the following Counties, thereby removing the warm-humid location designation.

TABLE R301.1 (N1101.10)
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

TEXAS

Bandera*
Dimmit*
Edwards*
Frio*
Kinney*
La Salle*
Maverick*
Medina*
Real*
Uvalde*
Val Verde*
Webb*
Zapata*
Zavala*

Reason: These 14 counties are in the Dry (B) moisture zone and therefore do not need to meet the requirements for Warm-Humid locations. This is based on the following studies *Calculation of Precipitation Data and Climate Zones for ASHRAE Standard 169, Prepared by: Sonia Zhang and Didier Thevenard* and *Numerical Logics Inc. and Steve Cornick National Research Council of Canada.* ASHRAE Std 169 is also working on revisions to these Figures and Tables based on the above studies.

Cost Impact: The code change proposal will not increase the cost of construction.

CE62-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C301.1-EC-ELLIS.doc

CE63 – 13
C303.1.1, R303.1.1 (IRC N1101.12.1)

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C303.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. <u>For insulated siding the *R-value* shall be labeled on the product's package and shall be *listed* on the certification.</u> The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R303.1.1 (N1101.12.1) Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. <u>For insulated siding the *R-value* shall be labeled on the product's package and shall be *listed* on the certification.</u> The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

Reason: This change will help building officials and energy specialists/raters identify insulated siding, including its specified R-value based on ASTM C1363 testing. Currently, labeling or identification marks are not specified for insulated siding, but have been developed and established since the publication of the last energy code. For more information, go to www.insulatedsiding.info.

Cost Impact: The code change proposal will have minimal cost impact as many insulated siding products are on the market and are certified and labeled in the way.

CE63-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

CE64 – 13

C202 (NEW), C303.1.1, C303.1.1.1 (NEW), C303.1.1.2 (NEW), C303.1.1.3 (NEW), Chapter 5, R202 (NEW) (IRC N1101.9 (NEW)), R303.1.1 (IRC N1101.12.1), R303.1.1.1 (NEW) (IRC N1101.12.1.1 (NEW)), R303.1.1.2 (NEW) (IRC N1101.12.1.1.2 (NEW)), R303.1.1.3 (NEW) (IRC N1101.12.1.1.3 (NEW)), Chapter 5

Proponent: Vickie Lovell, InterCode Incorporated, representing Reflective Insulation manufacturers Association International (Vickie@intercodeinc.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C303.1.1 Building thermal envelope insulation. An *R* value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the *building thermal envelope.* ~~For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness shall be *listed* on the certification.~~ The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

<u>**C303.1.1.1 Blown or sprayed fiberglass and cellulose insulation.** For blown or sprayed fiberglass and cellulose insulation the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be *listed* on the certification.</u>

<u>**C303.1.1.2 Sprayed polyurethane foam insulation.** For sprayed polyurethane foam (SPF) insulation the installed thickness of the areas covered and R-value of installed thickness shall be *listed* on the certification.</u>

<u>**C303.1.1.3 Reflective insulation.** Reflective insulation shall be labeled with the number of reflective sheets and the number and thickness of the enclosed air spaces to attain the product R-value as determined in accordance with ASTM C1224.</u>

Add new definitions as follows:

<u>**ENCLOSED AIR SPACE**. An unventilated cavity between two continuous surfaces (sheets) with a continuous border of building components.</u>

<u>**REFLECTIVE INSULATION.** An assembly with one or more surfaces with emittance of 0.1 or less with at least one low emittance surface that faces an enclosed air space.</u>

Add new standard to Chapter 5 as follows:

ASTM

<u>C1224-11 Standard Specifications for Reflective Insulation for Building Applications</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R303.1.1 (N1101.12.1) Building thermal envelope insulation. An *R* value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the *building thermal envelope.* ~~For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness shall be *listed* on the certification.~~ The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

R303.1.1.1 (N1101.12.1.1) Blown or sprayed fiberglass and cellulose insulation. For blown or sprayed fiberglass and cellulose insulation the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be *listed* on the certification.

R303.1.1.2 (N1101.12.1.2) Sprayed polyurethane foam insulation. For sprayed polyurethane foam (SPF) insulation the installed thickness of the areas covered and R-value of installed thickness shall be *listed* on the certification.

R303.1.1.3 (N1101.12.1.3) Reflective insulation. Reflective insulation shall be labeled with the number of reflective sheets and the number and thickness of the enclosed air spaces to attain the product R-value as determined in accordance with ASTM C1224.

Add new definitions as follows:

ENCLOSED AIR SPACE. An unventilated cavity between two continuous surfaces (sheets) with a continuous border of building components.

REFLECTIVE INSULATION. An assembly with one or more surfaces with emittance of 0.1 or less with at least one low emittance surface that faces an enclosed air space.

Add new standard to Chapter 5 as follows:

ASTM

C1224-11 Standard Specifications for Reflective Insulation for Building Applications

Reason: The section at present incorporates requirements that are specific to blown or sprayed fiberglass and cellulose insulation and to sprayed polyurethane foam insulation together with general requirements for building thermal envelope insulation materials. This proposal separates the generic and specific requirements.

The proposal also adds specific requirements similar to those for the other insulation materials (as well as appropriate definitions) for a type of material that has been in the market place for over 20 years and has had nationwide distribution and installation, namely reflective insulation. These products are well established and have two associated ASTM Standards, namely ASTM C727, Standard Practice for Installation and Use of Reflective Insulation in Building Constructions, and ASTM C1224, Standard Specification for Reflective Insulation for Building Applications. ASTM C1224 should be included in the IECC to provide the appropriate product specifications for reflective insulations.

ASTM C1224 can be viewed at: http://reflectixinc.com/literature/securedpdfs/C1224.pdf.

The products are currently included in the following state codes:

- FL – 2007 Florida Building Code, Section 719.1; 719.2.1 & Table 13-C1.2.3 & ASTM References Subchapter 13-3 (C1224)
- FL – 2010 Florida Building Code, Table 303.2 (ASTM Standards)
- MN - Thermal Insulation Standards, Section 7641.0130, Subpart 7

The purpose of this proposal is to incorporate into the IECC language that clarifies the pertinent requirements regarding reflective insulation R-values that are based on ASTM standards and shall be listed on certifications.

A companion proposal is being provided for section C303.

Cost Impact: This code change proposal will not increase the cost of construction.

Note: The two terms defined in this proposal are not found in other International Codes. However, the IBC does define 'reflective plastic core foil insulation' as follows:

> **REFLECTIVE PLASTIC CORE FOIL INSULATION.** An insulation material packaged in rolls, that is less than 0.5 inches thick, with at least one exterior low emittance surface (0.1 or less) and a core material containing voids or cells.

Analysis: A review of the standard proposed for inclusion in the code, C1224-2011 Standard Specifications for Reflective Insulation for Building Applications, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE64-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C303.1.1-EC-LOVELL.doc

CE65 – 13
C303.1.3, Chapter 5, R303.1.3 (IRC N1101.12.3), Chapter 5

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C303.1.3 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 ~~by an accredited, independent laboratory, and labeled and certified by the manufacturer~~.

> **Exception:** Where required, garage door U-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Table C303.1.3(1) or C303.1.3(2). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table C303.1.3(3).

Add new standard to Chapter 5 as follows:

DASMA

ANSI/DASMA 105-2004 Test Method for Thermal Transmittance and Air Infiltration of Garage Doors

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R303.1.3 (N1101.12.3) Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 ~~by an accredited, independent laboratory, and labeled and certified by the manufacturer~~.

> **Exception:** Where required, garage door U-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default *U*-factor from Table R303.1.3(l) or R303.1.3(2). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table R303.1.3(3).

Add new standard to Chapter 5 as follows:

DASMA

ANSI/DASMA 105-2004 Test Method for Thermal Transmittance and Air Infiltration of Garage Doors

Reason: Although NFRC 100 has been updated to include procedures for garage doors, there are instances where companies do not and cannot manufacture the 7' by 7' door size required to validate the NFRC 100 simulation by testing to NFRC 102. Research has shown that garage doors tested to ANSI/DASMA 105 result in U-factor values comparable to NFRC 100/NFRC 102. "Where required" indicates that the Exception only applies where garage doors are affected by conditioned space since there may be detached, non-conditioned structures where U-factor is not needed. We have separated the laboratory and labeling/certifying information since it applies to all doors including garage doors.

Cost Impact: The code change proposal will not increase the cost of construction.

CE65-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C303.1.3-EC-HETZEL.doc

CE66-13

C301.4 (NEW), R301.4 (NEW) (IRC N1101.10.3 (NEW)), R406 (NEW) (IRC N1106 (NEW))

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com), Agustin Mujica, Levitt Homes, Puerto Rico

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C301.4 Tropical climate zone. The tropical climate zone shall be defined as:

1. Hawaii, Puerto Rico, Guam, American Samoa, U.S. Virgin Islands, Commonwealth of Northern Mariana Islands, and
2. Islands in the area between the Tropic of Cancer and the Tropic of Capricorn

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R301.4 (N1101.10.3) Tropical climate zone. The tropical climate zone shall be defined as:

1. Hawaii, Puerto Rico, Guam, American Samoa, U.S. Virgin Islands, Commonwealth of Northern Mariana Islands, and
2. Islands in the area between the Tropic of Cancer and the Tropic of Capricorn.

R406. (N1106) Tropic zone option. *Residential buildings* in the tropical zone shall be deemed to comply with this Chapter where the following conditions are met:

1. Not more than one half of the *occupied space* is air conditioned.
2. The *occupied space* is not heated.
3. Solar, wind, or other renewable energy source supplies at least 80 percent of the energy for service water heating.
4. Glazing in *conditioned space* has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.2.1.1, or the roof has insulation with an *R-value* of R-15 or greater. If present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a minimum slope of one quarter inch per foot of run. The finished roof does not have water accumulation areas.
8. Operable fenestration provides ventilation area equal to a minimum of 14% of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with walls facing two different directions have operable fenestration facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest non-bedroom space.

Reason: This creates a Chapter 4 alternative for residences in the tropical climates as a new section. Tropical areas are quite different from the US mainland in climate, construction techniques, traditional construction, and energy prices. The IECC treats tropical climates as if they were simply a southern extension of the US mainland. Traditional residences, especially the less expensive residences, have evolved inexpensive ways to work with the tropical climates to provide comfortable interior spaces without the need for substantial space conditioning. Tropical electrical prices, usually over 20 cents per hWh, provide a substantial incentive for energy conservation. Solar water heating works particularly well in tropical climates.

This proposed change is meant to add a simple option for a newly defined climate zone, the "tropical zone". The area between the Tropic of Cancer and the Tropic of Capricorn is the area between 23.5° northern and southern latitude of the equator. A zone that recognizes the unusually constant and unique climate of this region would help make the ICC Codes more of an "international code".

Traditional construction, especially with solar water heating, is usually more energy efficient than the construction style assumed in the IECC, as is shown by an analysis done for Puerto Rico.[1] Using energy efficient versions of traditional construction saves more energy and is much more cost-effective than pushing those in tropical climates to adopt mainland construction practices. Traditional tropical construction focuses on greatly reducing or eliminating the need for space conditioning by making a living space that is comfortable without space conditioning.

The requirements proposed here are based on informal conversations with those who live in tropical regions. The proponent does not live in the proposed tropical zone and will continue to solicit the input of those who do. Some items were taken from energy codes proposed or in place in the tropical regions. This is not intended as a replacement for existing topical codes, such as the energy codes recently adopted in Hawaii and Puerto Rico. This is meant as a simple climate-appropriate alternative for tropical climates.

Reason by item:
#1 Air conditioning only a portion of the residence is common in some residences and saves energy compared to air conditioning the whole occupied space.
#2 Heating is seldom needed.
#3 Consistently warm temperatures and high power costs make solar water heating very attractive. Solar water heating is widely used. Water heating is often 35% or more of the residential energy use.[1,2] Substantial energy savings come from solar water heating.
#4 Limiting solar gains and providing ventilation is the energy focus for windows. Window U-factor has little impact. Window air tightness is of little value when the important feature of the windows is their ability to be operable and provide ventilation.
#5 High efficiency lighting makes sense with tropical energy prices.
#6 This references the "cool roof" provisions. This is similar to an option in Hawaii's code and the Puerto Rico Energy Center's analysis. Insulation is less valuable in mild climates where the outside temperature is often comfortable as an inside temperature.
#7 Even flat roofs need to drain.
#8 Ventilation provided by tropical winds makes occupied spaces more comfortable. 14% is an option for unconditioned residences in Hawaii's new energy code.
#9 When bedroom walls facing two directions are available, ventilation on both walls will be more effective.
#10 Interior doors should not block bedroom ventilation. This is similar to Hawaii's new energy code and recommended by the Puerto Rico Energy Center.
#11 Ceiling fans increase comfort without conditioning the air. This is similar to Hawaii's new energy code and recommended by the Puerto Rico Energy Center.

1. "Energy Modeling of Low Income Residencies" by C. G. Morales & A. J. Malavé
http://library.witpress.com/pages/PaperInfo.asp?PaperID=22547
The paper above is not free. The proponents will send a Puerto Rico Energy Center presentation done for DOE that summarizes that work to anyone who requests this by email.
2. Typical Hawaiin energy use for hot water: http://www.hawaiienergy.com/16/water-heating

Cost Impact: The code change proposal will not increase the cost of construction.

CE66-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C301.4 (NEW)-CONNER-MUJICA.doc

CE67 – 13

C303.1.4.1 (NEW), Chapter 5, R303.1.4.1 (N1101.12.4) (NEW), Chapter 5

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C303.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460) in units of h ×ft2 × °F/Btu at a mean temperature of 75°F (24°C).

<u>**C303.1.4.1 Insulated siding.** The thermal resistance (*R-value*) of insulated siding shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.</u>

Add new standard to Chapter 5 as follows:

ASTM

<u>C1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R303.1.4 (N1101.12.4) Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460) in units of h ×ft2 × °F/Btu at a mean temperature of 75°F (24°C).

<u>**R303.1.4.1 (N1101.12.4.1) Insulated siding.** The thermal resistance (*R-value*) of insulated siding shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.</u>

Add new standard to Chapter 5 as follows:

ASTM

<u>C1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus</u>

Reason: This additional requirement is necessary so that the testing protocol is spelled out clearly as the valid method for testing of R-value for insulated siding.

The Federal Trade Commission agrees that ASTM C1363 is the appropriate test method for insulated siding and further supported specific protocol as a part of ASTM C1363, established in ASTM D7793, is in the spirit of the home insulation rule.

Without adding this information to the energy code, manufacturers could try to enter the home insulation/insulated siding marketplace with product that has not been tested appropriately for R-value. This addition will ensure that proper, close to field condition testing, is required for any type of insulated siding to qualify as home insulation and in the energy code. This will ultimately result in a manufacturer compliance requirement and create easy enforcement for the building official and energy specialists. It will also further ensure that insulated siding's determined R-value will be legitimate in determining energy performance calculations and consumer confidence that it will provide specific energy performance.

This is a photo of a test chamber and insulated siding being tested to ASTM C1363.

Cost Impact: The code change proposal will have minimal cost impact as many insulated siding products are on the market and are certified and labeled in the way.

CE67-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C303.1.4.1 (NEW)-EC-DOBSON.doc

CE68 – 13
C303.1.4, R303.1.4 (IRC N1101.12.4)

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C303.1.4 Insulation product rating**. The thermal resistance (R-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission R-value rule (CFR Title 16, Part 460) in units of h ft^2°F/Btu at a mean temperature of 75°F (24°C).~~

PART II – IECC-RESIDENTIAL PROVISIONS

Delete without substitution as follows:

~~**R303.1.4 (N1101.12.4) Insulation product rating**. The thermal resistance (R-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission R-value rule (CFR Title 16, Part 460) in units of h ft^2°F/Btu at a mean temperature of 75°F (24°C).~~

Reason: Theses references were judged non-compliant with CP-28 by ICC staff in the year they were brought into the code. The IECC does not need to repeat Federal law. The code official is not responsible for enforcing the FTC requirements on the insulation manufacturers. When Federal law changes the reference will be out of date.

Cost Impact: This code change proposal will not increase the cost of construction.

CE68-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C303.1.4-EC-CONNER.doc

CE69 – 13
C401.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C401.1 Scope. The provisions ~~requirements contained~~ in this chapter are applicable to commercial *buildings* and their *building sites* ~~or portions of commercial buildings~~.

Reason: This proposal includes building sites in the scope of the IECC (consistent with C101.2). The other ICC codes use the terminology "provisions in this chapter…." The code was revised during the last code development cycle to clarify that building sites associated with the building are included due to the scope of the provisions in the lighting chapter. There is no need to include "or portions of commercial buildings" because that higher level scope is covered in Chapter 1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE69-13

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

C401.1-EC-WILLIAMS.doc

CE70 – 13
C401.2, C401.2.1

Proponent: Larry Spielvogel, PE, FASHRAE, representing self

Revise as follows:

C401.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings.

C401.2 Application. Commercial buildings shall comply with one of the following:

~~1. The requirements of ANSI/ASHRAE/IESNA 90.1.~~
~~2.~~ 1. The requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with either Section C406.2, C406.3 or C406.4.
~~3.~~ 2. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C401.2.1 Application to existing buildings. Additions, alterations and repairs to existing buildings shall comply with one of the following:

1. Sections C402, C403, C404 and C405; or
2. ~~ANSI/ASHRAE/IESNA 90.1~~.

Reason: The purpose of this code change is to delete the current option that exists to use ASHRAE 90.1 in lieu of all of the requirements in Chapter 4 of the Commercial Provisions in the IECC. This code change will make the IECC simpler, less expensive to use, easier to learn, and will prevent people from using ASHRAE 90.1 to get around the provisions of IECC Chapter 4 and other I Codes, such as the IMC.

1. ASHRAE 90.1-2013 Is Not and Will Not Be Available. Just like in previous code cycles, ASHRAE is not likely to publish an ANSI approved version of 90.1-2013 until just before or during the Final Action Hearings in Atlantic City in October 2013. Thus, it is not possible to see even a working draft of 90.1-2013 by the Committee Action Hearing in Dallas in April, and it may not even be possible to see the final published and ANSI approved 90.1 before the Final Action Hearings in October.

Therefore, any proposal to allow ASHRAE 90.1-2013 or even a working draft to be used by anyone in lieu of all of the specific requirements in IECC Chapter 4 is just not fair or equitable. ASHRAE must follow the ICC rules, just like all other consensus documents that are referenced, by providing ANSI approved and published copies well before the hearings. Otherwise, it is not possible for the IECC Committee or the ICC Members and the public to adequately review, comment, and testify on the content and provisions of the specific version of ASHRAE 90.1 that will be adopted.

2. ASHRAE 90.1 Circumvents IECC Requirements. The current option to use the less stringent ASHRAE 90.1 in lieu of all of the requirements in IECC Chapter 4 provides any user with multiple ways to circumvent many of the IECC and other I Code requirements. Thus, compliance with ASHRAE 90.1 can be less stringent than with IECC Chapter 4 compliance. It will not be possible for anyone to know until after all changes are made and adopted at the Final Action Hearings whether ASHRAE 90.1 is at least as stringent as Chapter 4 of the IECC. If 90.1 is not at least as stringent as Chapter 4, then you will allow these less stringent requirements in 90.1 to be used at will, defeating the purpose of having an energy code.

At least some of the lighting provisions in ASHRAE 90.1 (as yet unknown) are likely to be less stringent than those in C405.5.2(1) and (2) of IECC. ASHRAE 90.1 also allows additional lighting power allowances in that can be much higher than those in the footnotes to IECC Table C405.5.2(2). The IECC should not allow people to unilaterally circumvent IECC voted and adopted lighting power allowances without justification and public hearings. As another example, IECC C402.4.5.1 and C402.4.5.2 require the use of the 2010 AMCA standard 500D for dampers in Chapter 4, while ASHRAE 90.1-2010 requires the use of the 2007 AMCA Standard 500D in Section 12, and then only for damper leakage, while IECC requires AMCA 500-D-2010 for both damper leakage and for stairway and shaft vents. Thus, the option to use ASHRAE 90.1 circumvents the IECC required use of the current 2010 AMCA damper standard and ASHRAE 90.1 does not require its use in as many places as does the IECC.

3. ASHRAE 90.1 Is Unenforceable. ASHRAE 90.1 is unenforceable because the requirements are so numerous and so complex that most code officials do not have and cannot readily or economically get the extensive training and experience to be able to understand and enforce the ASHRAE 90.1 requirements. ASHRAE 90.1 has many more requirements than the IECC. The 2012 IECC is 89 pages, while 90.1-2010 is already 228 pages, with over 100 more new addenda to be included in the 2013 edition. The ASHRAE 90.1-2010 User's Manual is another 469 pages long. There are almost no local training courses or training programs on ASHRAE 90.1 at the many locations and jurisdictions where the IECC is adopted that are specifically for code officials. At best, there may be a dozen or so competent and comprehensive training programs on ASHRAE 90.1 each year in the entire country, mostly in a few major cities, and none of those is specifically for code officials. Learning and completely understanding ASHRAE 90.1 is also difficult even for most practicing architects, engineers, and contractors, making it difficult for them to comply, thus imposing an even greater burden on code officials to verify compliance.

Even the ASHRAE 90.1 committee itself has difficulty writing and understanding the standard, since they issue hundreds of addenda, errata, formal interpretations, and informal interpretations every year in attempts to change or clarify their intent and rectify their own numerous errors. The one-year-old addenda for ASHRAE 90.1-2010 is 44 pages long and many more pages are coming. So far, ASHRAE has issued 14 errata sheets to 90.1-2010. The addenda to 90.1-2007 that were incorporated into 90.1-2010 are designated from a to dr. The addenda so far to 90.1-2010 that will be incorporated into 90.1-2013 are designated from a to cr. Thus, the criteria, requirements, and corrections for ASHRAE 90.1 change almost weekly. Nor are the changes from the prior edition clearly marked by ASHRAE, as they are in the IECC, so the reader can readily see the changes and deletions. Which of these many documents and provisions are to be applied and enforced for any specific permit application on any specific day?

4. ASHRAE 90.1 is Not Coordinated. The IECC is carefully coordinated with the other International Codes, and ASHRAE 90.1 is not. This results in conflicts and contradictions. For example, just Chapter 4 of the IECC has at least eleven references to and requirements for compliance with the other International Codes, while ASHRAE 90.1 has not one. While some of the provisions in IECC are similar to ASHRAE 90.1, ASHRAE 90.1 has many more requirements and exceptions that do not exist in the IECC, providing more latitude and less stringency for users than in the IECC and other I Codes.

5. ASHRAE 90.1 is Not Unified. Providing the option to use ASHRAE 90.1 in lieu of IECC Chapter 4 diverts efforts from pursuing a unified and comprehensive set of International Codes. The option to use ASHRAE 90.1 in lieu of IECC Chapter 4 provides an unsupervised and unmonitored path for special and vested interests to include their provisions in ASHRAE 90.1 that would never be accepted in the IECC. For example, ASHRAE does not hold any public hearings on any changes to or on the entire standard. Thus, the “back door” to ASHRAE 90.1 opens wider than that for the IECC, especially since so many of the ASHRAE 90.1 voting members work for or represent special interests, so they can pursue those interests from the inside. For example, a significant percentage of the members of the ASHRAE 90.1 Mechanical Subcommittee are employed by manufacturers of heating, air conditioning, and water heating equipment, or by their trade associations. Most of the other voting members of the ASHRAE 90.1 Committee do not know enough to debate and vote intelligently on those issues, which are then adopted and included in the Standard. As another example, the majority of the voting members of the ASHRAE 90.1 Committee know little or nothing about lighting, so there is a great tendency to “rubber stamp” recommendations that come from the Lighting Subcommittee. Accordingly, many provisions in ASHRAE 90.1 diverge from those in IECC.

6. ASHRAE 90.1 Copies Unavailable. ASHRAE does not normally offer and provide free copies of 90.1 ($125 per copy last year plus another $99 for the User’s Manual) to code officials. Very few code jurisdictions have budgets to purchase copies of the ASHRAE documents for each plan checker and inspector; much less the estimated thousands of dollars per user to purchase the many mandatory ASHRAE references (beyond those in the IECC) needed to determine compliance. Few code jurisdictions, and similarly few architectural, engineering, or construction firms have the sophisticated software, training, and experience, much less the time and computers required to run and check the 90.1 Section 11 Energy Cost Budget (ECB) Method calculations allowed by ASHRAE 90.1 for further compliance options.

7. The Use of ASHRAE 90.1 is Not Precluded. Most, if not all relevant provisions of ASHRAE 90.1 can still be used at the discretion of the user, so long as they are at least as stringent as Chapter 4 of IECC. People who wish to comply with ASHRAE 90.1 for any other reasons, such as, but not limited to LEED® certification can still easily do so, provided they also meet the requirements of Chapter 4 of IECC.

Cost Impact: This code change proposal will not increase the cost of construction. There will be a very substantial cost savings since code officials and users of the IECC will not have to buy additional standards and references or spend the time and pay for additional training. The provisions proposed in this code change for deletion are simply optional already in the IECC, and no other provisions in the IECC will be changed or affected.

CE70-13

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

C401.2-EC-SPIELVOGEL.doc

CE71 – 13
C401.2, C406

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402, C403, C404 and C405. ~~In addition, commercial buildings shall comply with either Section C406.2, C406.3 or C406.4.~~
3. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7. The building energy cost shall be equal to or less than ~~85~~ 90 percent of the standard reference design building.

Delete without substitution as follows:

~~SECTION C406~~
~~ADDITIONAL EFFICIENCY PACKAGE OPTIONS~~

Reason: Stringency increases in the energy codes don't necessarily mean energy savings. Parts of the energy code are usually ignored. The sections eliminated here were added primarily to increase stringency, not because they solve a problem.

Most parts of Section C406 are problematic. As the Federally required equipment efficiency changes, the heating and cooling equipment in Section C406.2 will become out of date. As Federal minimum equipment efficiency requirements change the tables in Section 406.2 will become out of date; for example, the minimum air conditioner and heat pump efficiencies just changed. The minimum furnace efficiencies are expected to change in the next few years. Efficiencies sufficiently above the Federal requirements to be in that table may not even be available for some types of equipment. The solar renewable option in C406.4 will be difficult in dense urban settings, for example when buildings shade other buildings, or worse, when future buildings end up shading existing buildings where the renewables were dependent on sunshine. If efficient equipment is unavailable and renewables are impractical due to shading, the only remaining option is a lower lighting power density (LPD) in Section C406.3. The LPDs could be quite a challenge-- most required LPDs in Section C406.3 are more restrictive than ASHRAE's green standard (ASHRAE 189.1).

The goal of Section C406 was to reduce energy use by 5%. The 85% factor in Section C401.2 includes that 5%, so it is increased to 90% by this change to align it with the deletion of Section C406.

The IECC is changing too fast and becoming too complicated. We need to let code enforcement and those using the code catch up. The code complexity has outpaced the code enforcement community's ability to absorb more and more requirements. At some point we have to ask what is the contribution to energy efficiency for requirements that are not implemented? Or worse, what is the contribution for requirements that alienate potential users of the energy code to the point that they don't enforce, or even adopt, the IECC?

Cost Impact: The code change proposal will not increase the cost of construction.

CE71-13

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

C401.2-EC-CONNER

CE72 – 13
C401.2

Proponent: Mark Nowak, M. Nowak Consulting, LLC, representing Steel Framing Alliance

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
~~2.~~ ~~The requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with either Section C406.2, C406.3 or C406.4.~~
~~3~~ 2. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

   Exception: Buildings 25,000 gross square feet and less in floor area shall be permitted to comply with the same approach as for existing buildings and alterations in Section C401.2.1 and either Section C406.2, C406.3 or C406.4.

Reason: In order to reach the ultimate goal of net zero energy buildings, it will be necessary to move toward a code that is 100% performance oriented. The proposal will require designers to look at the most cost-effective ways to meet the code rather than rely on prescriptive solutions that offer less and less benefit at substantial cost to the owner and consumer. This proposal will also facilitate future improvements to the code for larger buildings. As cost effectiveness continues to be a difficult concept to address with any sort of consensus, this proposal will shift the debate toward the overall energy savings goal rather than continued debate over a range of individual components.

The proposal also recognizes that some smaller buildings, including multifamily buildings, are not as complex as larger buildings and thus retains alternative compliance paths for these building types.

Cost Impact: This proposal will not increase the cost of construction

CE72-13

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

C401.2-EC-NOWAK.doc

CE73 – 13
C202 (New), C401.2, C407.1, C407.3, C407.4 through C407.6.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with either Section C406.2, C406.3 or C406.4.
3. The requirements of Section C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 C405.7 and C407. ~~The building energy cost shall be equal to or less than 85 percent of the standard reference design building.~~

C407.1 Scope. This section establishes criteria for compliance using total expected ~~building~~ performance of a proposed building design in terms of *regulated energy use*. ~~The following systems and loads shall be included in determining the total building performance: heating systems, cooling systems, service water heating, fan systems, lighting power, receptacle loads and process loads.~~

~~**C407.3 Performance-based compliance.** Compliance based on total building performance requires that a proposed building (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official,* such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report. Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. Nondepletable energy collected off site shall be treated and priced the same as purchased energy. Energy from nondepletable energy sources collected on site shall be omitted from the annual energy cost of the *proposed design.*~~

> ~~**Exception:** Jurisdictions that require site energy (1 kWh =3413 Btu) rather than energy cost as the metric of comparison.~~

C407.3 Performance-based compliance. Total building performance shall be calculated and documented by a *registered design professional* in accordance with Appendix G of ANSI/ASHRAE/IESNA 90.1. and shall show a minimum a performance percentage improvement of 26 percent of *regulated energy use* when calculated in accordance with Section G.1.2 of Appendix G. Energy that is not *regulated energy use* shall be subtracted from both the *proposed design* and the baseline building after building performance simulations are completed, but prior to calculating the percentage improvement.

~~**C407.4 Documentation.**~~

~~**C407.4.1 Compliance report.**~~

~~**C407.4.2 Additional documentation.**~~

~~**C407.5 Calculation procedure.**~~

~~**C407.5.1 Building specifications**~~

~~**C407.5.2 Thermal blocks.**~~

~~**C407.5.2 Thermal blocks.**~~

~~**C407.5.2.2 HVAC zones not designed.**~~

~~**C407.5.2.3 Multifamily residential buildings.**~~

~~**TABLE C407.5.1(1)**~~
~~**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**~~

~~**TABLE C407.5.1(2)**~~
~~**HVAC SYSTEMS MAP**~~
~~**TABLE C407.5.1(3)**~~
~~**SPECIFICATIONS FOR THE STANDARD REFERENCE DESIGN HVAC SYSTEM DESCRIPTIONS**~~

~~**TABLE C407.5.1(4)**~~
~~**NUMBER OF CHILLERS**~~

~~**TABLE C407.5.1(5)**~~
~~**WATER CHILLER TYPES**~~

~~**C407.6 Calculation software tools.**~~

~~**C407.6.1 Specific approval.**~~

~~**C407.6.2 Input values.**~~

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

REGULATED ENERGY USE. Energy used for HVAC, lighting, service water heating, motors, transformers and other building systems, equipment, components, and processes with requirements prescribed in this code.

Reason: The target of 26% improvement in proposed section C407.3 above will change based on the final development of 90.1-2013 Appendix G. The percentage is intended to represent the improvement from the Appendix G baseline to the 90.1-2013 requirements. The percentage improvement required to satisfy the performance path is under development in the ASHRAE committees and is expected to be ready before the final 2015 IECC code hearings. The final percentage improvement required could range from 45% if the Appendix G baseline is set at 90.1-2004 levels (as currently proposed by SSPC 90.1) to 0% if the Appendix G baseline is set at 90.1-2013 levels.

This proposal intends to create in the IECC a singular performance path to compliance, and require compliance be based on a set reduction in energy cost for the proposed design over the standard design building.

Since the first energy codes and standards were published almost 40 years ago, there has always been a path to compliance that recognizes the ability for a building design to meet the intent of the energy code or standard without necessarily meeting each and every minimum prescriptive requirement. This path in the energy codes continues the concept embodied in the long-standing building code provision entitled “alternative methods and materials.” In short, the intent is to allow a designer to show that their building as designed will perform at or better than if it was just designed to meet the minimum code provisions.

While energy codes and standards provide criteria for HVAC, service water heating systems, and lighting systems on an independent basis with each provision having to be satisfied, it is understandable that one may wish to modify the design of prescriptive items and make up for increased energy use by increasing efficiency elsewhere in the building. For instance, one might want to provide fenestration that does not meet the prescriptive minimum code while at the same time implementing a reduction in connected lighting power below that allowed in the code. The intent is to allow the degree to which one building component or system does not meet minimum to be “traded off” against the degree to which one or more others exceed the minimum. This provision allows consideration of the building as a whole, recognizing that energy use and associated operating costs of a building occur “at the meter” and are the result of many interactions between the structure and the systems that provide the myriad of services in the building.

Although the concept of “equal or better” performance of the actual building design seems to indicate code compliance, it is not that simple. For most commercial buildings, such calculations require computer simulation by well-versed professionals along with a number of directions to ensure accurate results and minimization of gaming. Initially energy codes and standards had a singular set of criteria that were followed when conducting such building performance analysis. Since ASHRAE Standard 90 and the MEC (now the IECC) were maintained by different entities, the criteria associated with this compliance path digressed, in part because of the amount of time and effort stakeholders and others expended to update, maintain, and enhance the building performance approach. ASHRAE 90.1 has had and continues to have a long-standing focus on this path to compliance and is a referenced compliance path to the IECC pursuant to C401.2 (1). This raises the question—why have two separate processes focused on the same complex problem when it is simpler to rely on one?

It is for the following reasons that this change is proposed:

- Annual energy analysis and simulation is complicated and the governing rules more likely to improve if all interested and affected parties (e.g., design professionals) can focus their efforts on one approach.
- Code officials receiving compliance documentation associated with this path will have a uniform and singular set of inputs and outputs to get comfortable with in addition to knowing all results they receive are developed with the same identical "black box."
- Those with expertise in building energy modeling are heavily involved in development and updating of ASHRAE Standard 90.1, putting in easily a man-year of labor each year to keep the provisions in the standard current.

There is a possible reduction in construction cost and the costs associated with plan review and approval associated with this proposed change. Designers will have a single robust and technically supported approach to use for building performance, which should streamline their efforts. Similarly, code officials and plan reviewers will have a singular and uniform type of documentation to review.

Cost Impact: The code change proposal will not increase the cost of construction it may reduce the cost of construction.

CE73-13

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

C401.2-EC-WILLIAMS.doc

CE74 – 13
C401.2, C401.2.1, Chapter 5

Proponent: Michael A. Anthony, P.E., University of Michigan, representing US Education Facilities Industry – APPA.ORG – Leadership in Education

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections 502, 503, 504 and 505. In addition, commercial buildings shall comply with either Section 506.2, 506.3 or 506.4.
3. The requirements of Section 507, 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.
4. The requirements of ISO 50001.

401.2.1 Application to existing buildings. Additions, alterations and repairs to existing buildings shall comply with one of the following:

1. Sections 502, 503, 504 and 505; or
2. ANSI/ASHRAE/IESNA 90.1.
3. The requirements of ISO 50001.

Add new standard to Chapter 5 as follows:

ISO

50001-2011 Energy management systems – Requirements with guidance for use.

Reason: The US education facilities industry believes that a performance standard such as ISO 50001 is a more economical and faster path to meet our industry's energy conservation goals for the following reasons:

1. ISO 50001 provides a flexible template for states and local jurisdiction to implement local energy conservation programs that are most effective for their climates, risk aggregations and economy. For example, Section 4.4.4 of ISO 50001 states:

"The organization shall establish an energy baseline(s) using the information I the initial energy review, considering a data period suitable to the organization's energy use and consumption. Change in energy performance shall be measured against the energy baseline(s)"

2. The US Department of Energy (DOE) supports the ISO 50001 Standard as a proven approach for U.S. industrial and commercial facilities to plan, manage, measure, and continually improve energy performance.

Note to Committee: release of restricted copies of ISO 50001 for committee examination is in process

Cost Impact: The code change proposal will not increase the cost of construction. Lower cost because local jurisdictions will be able to a) establish their own baselines, and b) scale into energy conservation measures as technical and budget conditions allow as long as they meet established goals.

Analysis: A review of the standard proposed for inclusion in the code, ISO 50001-2011 Energy management systems – Requirements with guidance for use, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE74-13

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

C401.2-EC-ANTHONY

CE75 – 13
C401.2.2 (NEW)

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Add new text as follows:

C401.2.2 Application to replacement fenestration products. Where some or all of an existing *fenestration* unit is replaced with a new *fenestration* product, including sash and glazing, the replacement *fenestration* unit shall meet the applicable requirements for *U-factor* and *SHGC* in Table C402.3.

> **Exception**: An area-weighted average of the *U-factor* of replacement fenestration products being installed in the building for each fenestration product category listed in Table C402.3 shall be permitted to satisfy the *U-factor* requirements for each fenestration product category listed in Table C402.3. Individual fenestration products from different product categories listed in Table C402.3 shall not be combined in calculating the area-weighted average *U-factor*.

Reason: The purpose of this code change is to create a new code section to clarify that whenever an entire new fenestration product or assembly replaces some or all of an existing fenestration product (typically in the remodeling or modernizing of an existing building), the new fenestration product must meet the U-factor and SHGC requirements of the fenestration table. Section C401.2.1 of the 2012 IECC already requires that additions, alterations and repairs comply with C402 (thermal building envelope) – as a result this proposal does not add any additional requirements. However, this proposal will further clarify the application of the requirements, increase effective enforcement, and reduce the likelihood of confusion and differing interpretations:

- This proposed commercial fenestration requirement is identical to the residential requirement in Section R402.3.6. This specific requirement has been in the residential chapter of the IECC since at least the 2000 *IECC*. The exception adds additional flexibility by allowing the U-factor requirement to be satisfied on a weighted average basis by product category consistent with the current area-weighting approach to U-factor in section C402.3.4.
- Existing buildings represent one of the greatest untapped sources of energy efficiency, yet there are few ways to effectively require improvements to these buildings. This section does not mandate the replacement of windows; however, if windows are going to be replaced, the code should expressly require that the replacement windows achieve the same efficiency level as windows in newly constructed buildings.
- There is no valid reason why replacement windows cannot meet the same thermal efficiency requirements as windows installed in new buildings, so there is no reason to have separate requirements for them.
- Common repairs to damaged windows, such as the replacement of a broken pane of glass, would not be covered under C401.2.2.

Cost Impact: The code change proposal will not increase the cost of construction.

CE75-13

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

C401.2.2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE76 – 13
C401.3 (NEW), C401.3.1 (NEW), C401.3.2 (NEW), C401.3.3 (NEW)

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Add new text as follows:

C401.3 Additional requirements for inflated structures. Inflated structures with heating equipment installed shall be in accordance with this section.

C401.3.1 Envelope requirements. Foundation walls and slab-on-grade floors shall meet the requirements for conditioned spaces.

C401.3.2 Membrane insulation. Membranes shall have a minimum insulation value of R-12.

> **Exception:** Inflated structures that are designed to deflate during the summer months.

C401.3.3 Air pressure controls. Structure air pressure shall have capacity to be controlled both manually and automatically with respect to outdoor wind speed.

Reason: These provisions have been in the Minnesota Commercial Energy Code for many years and are necessary to address inflated structures that are used in northern climates, especially during the winter months. A minimum insulation value of R-12 is reasonable when a heating system is installed to ensure that energy is conserved. based on a report completed for the Minnesota Department of Commerce, State Energy Office, in May 2002 titled “Energy Conservation Strategies for Air Supported Structures.”

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

CE76-13

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

C401.3 (NEW)-EC-MANZ.doc

CE77 – 13
C402.1, C402.1.1, C402.1.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1 General (Prescriptive). ~~The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.~~ Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in Item 2 of Section C401.2, shall comply with the following:

1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the *R*-value based method of Section C402.1.1 or the *U-, C-* and *F*-factor based method of Section C402.1.2;
2. Fenestration in building envelope assemblies shall comply with Section C402.3; and
3. Air leakage of building envelope assemblies shall comply with Section C402.4.

Alternatively, where buildings have a vertical fenestration area or skylight area that exceeds that allowed in Section C402.3, the building and the building thermal envelope shall comply with Section C401.2 Item 1 or Section C401.2 Item 3.

C402.1.1 ~~**Insulation and fenestration criteria.**~~ **Insulation component *R*-value-based method.** ~~The *building thermal envelope* shall meet the requirements of Tables C402.2 and C402.3~~ For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R-value*-basis, the *R*-values for insulation in framing cavities, and for continuous insulation, shall be not less than that specified in Table C402.2, based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. ~~Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1~~.

C402.1.2 ~~***U*-factor alternative.**~~ **Assembly *U*-factor, *C*-factor and *F*-factor-based method.** ~~An assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2.~~ *Building thermal envelope* opaque assemblies intended to comply on an assembly *U*-factor, *C*-factor or *F*-factor basis shall have a *U*-factor, *C*-factor, or *F*-factor that is not greater than that specified in Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2.

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

a) This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code.
b) These sections are proposed to be revised to *clarify* that fact that the code contains both *insulation component R-value* and *assembly U-/C-/F-factor* methods, either of which can be used to comply with the code's prescriptive building thermal

envelope provisions, and that they both methods are equally valid and independently useable. These proposed revisions are also intended to ***clarify*** the application of both of these available methods.

c) The reference to Section C401.2, Item 2, in the first sentence of this proposal is intended to tie to the general scoping provisions of Chapter 4 and, in particular, the prescriptive IECC path.) Section C401.2 clearly indicates that Section C402 is applicable only in the compliance path outlined in Item 2 and is *not* applicable to the compliance paths outlined in Items 1 and 3.

d) The intent of the code is that the method described in Section C402.1.1 is applicable to insulation components, while the method described in Section C402.1.2 is intended to apply to entire assemblies. As currently written, however, there is unnecessary interaction between the two prescriptive building thermal envelope methods/sections and the tables that they reference. This clouds their application. It also makes the *U*-factor method in particular extremely difficult to decipher and apply.

For example, the verbiage as written in Section C402.1.1 gives the appearance that the insulation layers are mandatory. In reality, however, these "prescriptive" R-values are only one of many possible wall combinations. This creates confusion in building community: they feel that the R-values are required and there is not an option.

In many scenarios it becomes critical that the availability of these options is communicated effectively by the code. For example, most seismically active locations (Oregon, WA, ID, MT) utilize 6" stud construction for low rise commercial construction. The walls under Table C402.1.2, however, are for 4" stud construction, which is uncommon in all but high-rise construction in these regions. It becomes critical, therefore, that the requirements related to Table C402.2 be readily understood and useable.

e) This proposal takes the references to the U-factor method out of the R-value method provisions of Section C402.1.1 and moves them to a more appropriate location: to the general building envelope provisions of Section 402.1.

f) Although current text indicates that the U-factor method is an alternative in Section C402.1.1, the current text of Section C402.1.1 appears to presents another alternative: to comply with the prescriptive building envelope provisions of ASHRAE 90.1. This alternative is presented in the last sentence of the current text of Section C402.1.1. However, Section C401.2 clearly indicates that Section C402 is applicable only to the prescriptive compliance path outlined in Item 2 to Section C401.2. This proposal, therefore, moves the text referencing ASHRAE 90.1 from the last sentence of Section C402.1.1 to the general prescriptive provisions of Section C402.1 but, instead of directly referencing ASHRAE 90.1, the proposed language now references the ASHRAE 90.1 compliance path of Item 1 to Section C401.2 and the IECC performance path of Item 3 to Section C401.2. The SEHPCAC has been advised by the original proponents of Sections C401.2 and C402.1.1 that the intent is that these compliance paths outlined in Items 1, 2 and 3 to Section C401.2 be used separately and should not be mixed and matched. This change clarifies that by essentially sending the user to ASHRAE 90.1 or the IECC performance path whenever the IECC prescriptive building envelope provisions of Section C402 are not satisfied. Specifically, high glass buildings (buildings with over 30% vertical fenestration area) do not comply with Section C402.3 (or, more specifically, subsection C402.3.1) and, as such, are directed by the proposed language to Item 1 or 3 of Section C401.2.

In reality, the proposed language in the last sentence to Section C402.1 is unnecessary. Any reference to ASHRAE 90.1 for prescriptive building thermal envelope requirements should be deleted from Section C402.1 because Section C401.2 already puts forth the three available commercial energy compliance paths and adequately covers the ASHRAE 90.1 alternative issue. Thus, references to ASHRAE 90.1 or other alternative energy compliance paths in Sections C402.1 orC402.1.1 only serve to add confusion. However, in the spirit of this code change, which is to reorganize and clarify, not to raise questions regarding intent, the language addressing these issues was simply moved from Section C402.1.1 to Section C402.1 and modified. Thus the tie to ASHRAE 90.1 remains in Section C402 but is clarified. So as not to jeopardize the success of this proposal, the SEHPCAC has also created a separate proposal to delete the existing reference to ASHRAE 90.1 in Section C402.1.1.

g) The general provisions of Section C402.1 have been revised to clearly indicate the requirements in Section C402 that are specifically applicable to the R-value method of Section C402.1.1, the U-factor method of Section C402.1.2, and the ASHRAE 90.1 building envelope alternative method. Where a provision is applicable to all methods/alternatives, the information now appears in the general provisions of Section C402.1. Where a provision applies to only one method, the provision is referenced in the body of the provisions for that specific method.

h) This proposal revises the section titles, as well as the text of the indicated sections, to clarify that the R-value method applies to individual insulation components, while the U-factor method apples to entire assemblies. Furthermore, typical I-Code format conventions require that code text stand on their own without the aid of the title. These revisions achieve that. That said, the use of the code is simplified wherever section titles are accurate, and this gives further justification to the proposed title revisions.

i) As *R*-values are minimum values and *U*-factors are maximum values, these sections have been revised to clearly indicate this and eliminate unintended misapplication of the tables. Note that many users incorrectly assumed that both tables contained minimum values.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE77-13

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

C402.1 #1-EC-THOMPSON-SEHPCAC.doc

CE78 – 13

C402.1, C402.1.1, C402.1.2, Table C402.1.2, C402.2, Table C402.2, C402.2.1, C402.2.3, C402.2.4, C402.2.5, C402.2.6, C402.2.7, C407.5.1, Table C407.5.1(1)

Proponent: Larry Williams, Steel Framing Industry Association

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. ~~Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.~~

C402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables C402.1 and ~~C402.2.~~C402.3 based on the climate zone specified in Chapter 3. ~~Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1.~~

~~**C402.1.2 *U*-factor alternative.** An assembly with a *U*-factor, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-value in Table C402.2.~~ Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table ~~C402.1.2~~ C402.1. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table ~~C402.1.2~~ C402.1.

TABLE ~~C402.1.2~~ C402.1
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, Below Grade																
Below-grade wall[b]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55
Opaque Doors[c]																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37

a. Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted, provided the construction complies with the applicable construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.
b. Where heated slabs are below grade, below-grade walls shall comply with the *F*-factor requirements for heated slabs.
c. Roll-up or sliding doors shall have a maximum U factor of 0.21 or minimum R-4.75

C402.2 Specific insulation requirements (Prescriptive). ~~Opaque assemblies shall comply with Table C402.2.~~ Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. If the continuous insulation board manufacturer's installation instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

~~TABLE C402.2~~
~~OPAQUE THERMAL ENVELOPE REQUIREMENTS~~[a]

C402.2.1 Roof assembly. ~~The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly.~~ Roof assemblies shall meet the requirements of Table 402.1. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly ~~with the *R*-value specified~~ in Table ~~C402.2~~ C402.1.
2. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

C402.2.3 ~~Thermal resistance of~~ Above-grade walls. ~~The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly.~~ ~~The *R*-value of~~ Above-grade walls shall meet the requirements of Table 402.1. Integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table ~~C402.2~~ C402.1.

"Mass walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m^2) of wall surface area; or
2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).

C402.2.4 ~~Thermal resistance of~~ Below-grade walls. ~~The minimum thermal resistance (*R*-value) of the insulating material installed in, or continuously on, the below-grade walls shall be as specified in Table C402.2, and~~ Below-grade walls shall meet the requirements of Table 402.1. Insulation required to comply with Table 402.1 shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the floor, whichever is less.

C402.2.5 Floors over outdoor air or unconditioned space. ~~The minimum thermal resistance (*R*-value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Table C402.2, based on construction materials used in the floor assembly.~~ Floors over outdoor or unconditioned space shall meet the requirements of Table 402.1.

"Mass floors" shall include floors weighing not less than:

1. 35 psf (170 kg/m^2) of floor surface area; or
2. 25 psf (120 kg/m^2) of floor surface area if the material weight is not more than 12 pcf (1,900 kg/m^3).

C402.2.6 Slabs on grade. Where the slab on grade is in contact with the ground, the ~~minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table C402.2. The~~ slab shall meet the requirements of Table 402.1. Insulation required to comply with Table 402.1 shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

> **Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C407.5.1 Building specifications. The *standard reference design* and *proposed design* shall be configured and analyzed as specified by Table C407.5.1(1). Table C407.5.1(1) shall include by reference all notes contained in Table ~~C402.2~~ C402.1.

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Roofs	Type: Insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table ~~C402.1.2~~ C402.1	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: Mass wall if proposed wall is mass; otherwise steel-framed wall	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table ~~C402.1.2~~ C402.1	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: Mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: from Table ~~C402.1.2~~ C402.1 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table ~~C402.1.2~~ C402.1	As proposed
Floors, slab-on-grade	Type: Unheated	As proposed
	F-factor: from Table ~~C402.1.2~~ C402.1	As proposed
Doors	Type: Swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: from Table ~~C402.2~~ C402.1	As proposed

(Portions of Table not shown remain unchanged)

Reason: This proposal eliminates the compliance path based on R-values and leaves only the U factor alternative. In practice, the Opaque Thermal Envelope Requirements (R values) in existing Table C 402.2 are used as default values in early project cost estimating. Given these values are far from optimal or cost effective solutions, they introduce a bias against major groups of building materials. A far better approach would be a total building simulation or component U factor approach independent of materials. This proposal is a move toward a material-neutral code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE78-13

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

C402.1-EC-WILLIAMS rev.doc

CE79 – 13
C402.1.1, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables ~~C402.2~~ C402.1.1 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table ~~C402.2~~ C402.1.1. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table ~~C402.2~~ C402.1.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1.

TABLE ~~C402.2~~ C402.1.1
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

(Portions of Table not shown remains unchanged.)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code. Detailed reasons are as follows:

a) The current numbering of Table C402.2 adds confusion to the application of the codes prescriptive building thermal envelope R-value method.
b) This proposal changes the numbering of Table C402.2 to Table C402.1.1 to coordinate with number of the primary and initial section that references it: Section C402.1.1 (which references the table three times).
c) Due to the existing numbering anomaly, Table C402.2 is currently located in the code AFTER the table for the U-factor method referenced in Section C402.1.2 (which, by the way, appropriately references a table of the same number: Table C402.1.2). Code officials tell us that many architects, engineers, and contractors are confused by the order and incorrectly conclude that the only way to comply is to have the continuous insulation, regardless of the U-value of the assembly.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE79-13

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

C402.1.1 #2-EC-THOMPSON-SEHPCAC.doc

CE80 – 13
C402.1.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov); Jeff Inks, Window & Door Manufacturers Association (jinks@wdma.com)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables C402.2 and C402.3, based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. ~~Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1~~.

Reason: Thompson: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows: The last sentence of Section C402.1.1 was intended to prohibit buildings with vertical fenestration or skylight area that exceeds that allowed by Section C402.3from using the IECC prescriptive envelope provisions. It was also intended to send the user to alternative compliance paths where they exceed the vertical fenestration or skylight area allowed by Section C402.3. However, as written, the language appears to allow ASHRAE 90.1 building envelope prescriptive provisions to be mixed with other IECC prescriptive path requirements. That is not the intent. This proposal deletes the last sentence of Section C402.1.1 to add clarity and ensure that only one of three paths available in Section C402.1 are applied to each building and that these available energy compliance paths are not mixed and matched.

Note that, though this proposed change was also submitted by the SEHPCAC as a part of a lager package of related proposals, in the event that the larger proposal might fail, it was considered important enough to also be considered independently.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Inks: This provision needs to be removed as the building envelope provisions of ASHRAE 90.1 are too inconsistent with the envelope provisions of the IECC especially for vertical fenestration. Allowing an increase in fenestration area under the prescriptive path by way of ASHRAE 90.1 works for non-metal fenestration products as the U-factor requirements in ASHRAE 90.1 are more stringent for them than the IECC. However, that is not the case for nearly all other fixed and operable metal framed products in zones 2-8 for which the U-factor requirements in ASHRAE 90.1 are far <u>less</u> stringent than those in the IECC meaning that as the fenestration area of metal framed products increases, the thermal performance requirements for them decreases. That should not be permitted. If the intent of IECC is to allow the fenestration area under the prescriptive path to exceed that which is allowed under Section C402.3.1, then it should be expressly permitted in the IECC where the intent of IECC can be maintained and not compromised by allowing a decrease in the energy efficiency requirements when the fenestration area exceeds 30%.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE80-13

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

C402.1.1-EC-THOMPSON-SEHPCAC-INKS.doc

CE81 – 13
C402.1.1

Proponent: Brian Dean,, ICF, International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Sections C402.2 and C402.3, including Tables C402.2 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed ~~in Table~~ by Section C402.3.1 shall use one of the other compliance methods specified in Section C401.2 ~~comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1~~.

Reason: The purpose of the proposed code change is to clarify that commercial buildings built to the prescriptive option under Section 402 must meet all the requirements of the insulation and fenestration sections, and not just the prescriptive tables. We are not aware of any widespread misapplication of these requirements, but it is important to refine code language wherever there is any potential ambiguity. The revision above will ensure that the opaque envelope components meet the requirements of the prescriptive R-value or U-factor table, as well as all of the specific requirements as to the proper installation of insulation components. Likewise, the revisions will ensure that fenestration meets all of the associated requirements outlined in Section C402.3, and not just the prescriptive U-factor and SHGC requirements in Table C402.3.

In addition, the proposal correctly points buildings with more than the maximum allowed prescriptive fenestration area to the two other compliance methods available under section C401.2 – the performance path under section C407 and *ASHRAE 90.1*. The current language incorrectly suggests that compliance can be achieved only through the provisions of *ASHRAE 90.1*.

Cost Impact: The code change proposal will not increase the cost of construction.

CE81-13

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

C402.1.1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doca

CE82 – 13
C402.1.1, C402.1.2, C402.2.4

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables C402.2 and C402.3, based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1. The thermal resistance or R-value of the insulating material installed in, or continuously on, below grade exterior walls of the building envelope required in accordance with Table C402.2 shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.

C402.1.2 *U*-factor alternative. An assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2. The C-factor for the below grade exterior walls of the building envelope, as required in accordance with Table C402.1.2, shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.

~~**C402.2.4 Thermal resistance of below grade walls.** The minimum thermal resistance (*R*-value) of the insulating material installed in, or continuously on, the below-grade walls shall be as specified in Table C402.2, and shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.~~

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code. Detailed reasons are as follows:

This proposal moves and clarifies, but does not delete the provisions of Section C402.2.4 of the 2012 IECC.

As originally written, Section C402.2.4 requires that both the R-value and the U-factor methods of Sections C402.1.1 and C402.1.2 comply with the R-values for above grade wall insulation indicated in Table C402.2. However, only R-values are listed in Table R402.2. It does not make sense to require the U- factors method of Table R401.1.1, which contains values for below grade insulation, to also comply with the R-value method for below grade insulation. Section C402.2.4 is really intended to require that the thermal properties required for below-grade walls under either method extend at least 10 feet below grade or to the floor level, whichever is less. This proposal clarifies that by adding footnotes to the tables associated with both of these methods. It is only by the application of these tables that this information becomes relevant. Where these requirements are currently located they become disconnected and their application to the tables becomes unclear and unlikely.

Note that the R-values in Table C402.2 are based on analysis of the insulation components only. Although a wall without any insulation would have an R-value of 0, it has a C-factor of 0.1140. This is because the U-values for walls in Table C402.1.2 are based on the impact of all components of the building envelope assembly, not just the insulation components. The values in Table C402.1.2 consider the impact of all materials that compose each building envelope assembly, including whether block, wood stud, metal stud, solid concrete or other materials are used, and the amount of and location of the insulation components. Because Tables C402.1.2 and C402.2 evaluate thermal properties in different ways, it is important that the thermal resistance of below grade walls are addressed in a manner that consistent with the manner that they are addressed in each table. This proposal accomplishes that goal and preserves the potential application of each table to below grade walls.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE82-13

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

C402.1.1 #4-EC-THOMPSON-SEHPCAC.doc

CE83 – 13
C402.1.2

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

Revise as follows:

C402.1.2 U-factor alternative. An assembly with a U-factor, C-factor, or F-factor equal to or less than that specified in Table C402.1.2 shall be permitted as an alternative to the R-value in Table C402.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the U-factor, C-factor, or F-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the U-factor, C-factor or F-factor from the "All other" column of Table C402.1.2. <u>All U-factor and C-factor calculations shall take into account as applicable exposed edges of floor slabs.</u>

Reason: Slab edges are a location for heat loss and are frequently omitted from calculations.

Cost Impact: The change proposal will not increase the cost of construction. It adds no new energy requirement.

CE83-13

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

C402.1.2-EC-TAYLOR.doc

CE84 – 13

C202 (NEW), C402.1.2.1 (NEW), R202 (NEW) (IRC N1101.9 (NEW)), R402.1.3.1 (NEW) (IRC N1102.1.3.1 (NEW)), R402.1.4 (IRC N1102.1.4)

Proponent: Jay Crandell, ARES Consulting, representing American Chemistry Council- Foam Sheathing Committee (jcrandell@aresconsulting.biz)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

SECTION C202
GENERAL DEFINITIONS

C402.1.2.1 Airspace *U*-factor. Where the *U*–factor of an airspace enclosed within an assembly is used as part of the calculation of the assembly *U*-factor, the airspace shall be constructed as an *ideal airspace.* The thermal resistance of the air-space shall be determined in accordance with the ASHRAE *Handbook of Fundamentals* or tested in accordance with Section C303.1.4 for the applicable direction of heat flow. Where the air-space is not constructed as an *ideal airspace*, thermal resistance of the air-space shall not be included in the assembly *U*-factor.

Add new definition as follows:

IDEAL AIRSPACE. An airspace contained within a cavity of a field-built assembly that, where used to contribute to thermal resistance of the assembly, is bounded on all sides by solid materials with joints and gaps between bounding materials or holes in bounding materials sealed to prevent air movement into or out of the airspace.

PART II – IECC-RESIDENTIAL PROVISIONS

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

Revise as follows:

R402.1.3.1 (N1102.1.3.1) Airspace U-factor. Where the U–factor of an airspace enclosed within an assembly is used as part of the calculation of the assembly U-factor, the airspace shall be constructed as an *ideal airspace.* The thermal resistance of the air-space shall be determined in accordance with the ASHRAE *Handbook of Fundamentals* or tested in accordance with Section R303.1.4 for the applicable direction of heat flow. Where the air-space is not constructed as an *ideal airspace*, thermal resistance of the air-space shall not be included in the assembly U-factor.

R402.1.4 (N1102.1.4) Total UA alternative. If the total *building thermal envelope* UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table R402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The U-factor contribution of airspaces enclosed within an assembly shall comply with Section R402.1.3.1. The SHGC requirements shall be met in addition to UA compliance.

Add new definition as follows:

IDEAL AIRSPACE. An airspace contained within a cavity of a field-built assembly that, where used to contribute to thermal resistance of the assembly, is bounded on all sides by solid materials with joints and gaps between bounding materials or holes in bounding materials sealed to prevent air movement into or out of the airspace.

Reason: The ASHRAE Handbook of Fundamentals, Chapter 26, Table 3 lists the allowable thermal properties for airspaces in a variety of configurations. Footnote b to this table says in part " … Values apply for ideal conditions (i.e., air spaces of uniform thickness bounded by plane, smooth, parallel surfaces with no air leakage to or from the space)..". This concern is unique to the use of an air-space for thermal resistance for a number of reasons. First, an air-space creates a path of least resistance for any air infiltration and this makes air-space thermal performance particularly susceptible to loss of thermal performance due to air infiltration. The test basis and analytical basis of these airspace thermal values are based on ideal conditions or an "ideal airspace" that, most importantly, allows for no air leakage to or from the airspace. In essence, a field-built air-space is intended to trap air as well as sealed or manufactured mass insulation products that provide at least some resistance to air-movement. Furthermore, air-space thermal performance is dynamic, dependent on both heat flow direction and temperature difference. As such, use of the ASHRAE Fundamentals values for thermal resistance of airspaces requires the user to use boundary conditions similar to those used to establish the thermal values. Alternatively, the performance of non-ideal air spaces which allow some amount of air-leakage into or out of the airspace must have reduced (non-ideal) thermal performance qualified by appropriate testing with representative boundary conditions. Unfortunately, such a standardized test method does not currently exist. Without this proposal to provide clear enforceable language consistent the technical basis of airspace thermal performance, use of air-space thermal properties will continue to be determined based on ideal conditions that are often far from those actually provided in practice, resulting in performance that can be, in worst case, as little as 15% of that claimed based on ideal airspace conditions (refer to independent lab test data reported at http://fsc.americanchemistry.com/Energy-Code/Energy-Code-Compliance.pdf) .

Cost Impact: The code change proposal will not increase the cost of construction.

CE84-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C402.1.2.1 (NEW)-EC-CRANDELL.doc

CE85 – 13
C402.1.2.1 (NEW), Table C402.2.3 (NEW)

Proponent: Mark Nowak, M. Nowak Consulting LLC, representing Steel Framing Alliance

Add new text as follows:

C402.1.2.1 Thermal resistance of cold-formed steel walls. U-factors of walls with cold-formed steel studs shall be permitted to be determined in accordance with Equation 4-X:

$U = 1/[R_s + (R_{ins} \times F_c)]$ **Equation 4-x**

Where:

R_s = The cumulative R-value of the wall components along the path of heat transfer, excluding the cavity insulation and steel studs.
R_{ins} = The R-value of the cavity insulation.
F_c = The correction factor from Table 402.2.3

TABLE C402.2.3
F_c VALUES FOR STEEL STUD WALL ASSEMBLIES

Nominal stud depth (inches)	Spacing of framing (inches)	Cavity R-Value	Correction factor (F_c)
3-1/2	16	13	0.46
		15	0.43
3-1/2	24	13	0.55
		15	0.52
6	16	19	0.37
		21	0.35
6	24	19	0.45
		21	0.43
8	16	25	0.31
8	24	25	0.38

Reason: This proposal addresses a gap in the code in regard to calculating U-factors for steel stud wall assemblies. The proposed equation and correction factors are the same as those in the 2003 IECC residential section. They were removed in favor of simplistic prescriptive solutions in the 2004 and later editions. The code has lacked direction in the commercial section for determining U factors of cold-formed steel assemblies. Although the 2003 edition only contained this equation in the residential section, the assumptions underlying the methodology are equally applicable to commercial buildings. The same calculation procedure is recognized in ASHRAE 90.2. It is also the same methodology used by the ASHRAE 90.1 envelope subcommittee in developing the U factor tables in Appendix Table A.3.3 (Assembly U-Factors for Steel-Framed Walls) for non-residential buildings. Inclusion of the equation and correction factors in this section of the IECC will provide users with a calculation method without the need to refer to additional references for U-factors of conventional C-shaped steel stud walls. It will enable calculations with varying levels of cavity and continuous insulation for compliance with the envelope requirements in Section C402.

Cost Impact: The code change proposal will not increase the cost of construction.

CE85-13

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

C402.1.2.1 (NEW)-EC-NOWAK.doc

CE86 – 13
C402.1, C402.1.3 (NEW)

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 <u>or Section C402.1.3</u> shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.

<u>**C402.1.3 Total UA alternative.** Proposed buildings with a total building UA equal or less than the code-target total building UA shall be considered in compliance with Section C402.1. The UA for each assembly is the area or perimeter of that assembly times the applicable U-factor, C-factor or F-factor for that assembly. The building total UA is the sum of UAs for the assemblies. The area or perimeter for each assembly shall be as proposed. The code-target U-factor, C-factor or F-factor shall be the applicable value from Tables C402.1.2 and C402.3. The proposed building U-factor, C-factor or F-factor shall be that of the proposed assembly.</u>

<u>The code-target *U*-factors for skylight areas greater than 3 percent of the roof and above-grade wall fenestration areas greater than 30 percent shall be the U-factors of the surrounding opaque assembly.</u>

<u>**C402.3.4 Area-weighted SHGC.** An area-weighted average of fenestration products more than 50-percent glazed shall be permitted to satisfy the SHGC requirements.</u>

Reason: The commercial IECC does not specifically allow a UA tradeoff. This UA tradeoff similar to the residential UA tradeoff in Section R402.1.4 in the residential IECC. This change explicitly allows an area-weighted average of fenestration SHGC as is currently allowing for residential in Section R402.3.2.

Cost Impact: The code change proposal will not increase the cost of construction.

CE86-13

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

C402.1-EC-CONNER

CE87 – 13
C402.1, C402.1.3 (NEW), C402.3.4 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1, Section C402.1.2, or Section C402.1.3 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.

C402.1.3 Total UA alternative. Proposed buildings with a total building UA equal to or less than the code-target total building UA shall be considered in compliance with Section C402.1. The UA for each assembly is the area or perimeter of that assembly times the applicable U-factor, C-factor, or F-factor for that assembly. The building total UA is the sum of UAs for the assemblies. Proposed fenestration and skylights shall be subject to limits under Section C402.3.1. The area or perimeter for each assembly shall be as proposed. The code-target U-factor, C-factor, or F-factor shall be the applicable value from Tables C402.1.2 and C402.3. The proposed building U-factor, C-factor, or F-factor shall be that of the proposed assembly and shall be calculated in accordance with the ASHRAE Fundamentals Handbook, from ANSI/ASHRAE/IESNA 90.1 Appendix A, or results of laboratory measurements according to acceptable methods of test. Use of opaque assembly U-factors, C-factors, and F-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted for the proposed assemblies, provided that the construction complies with the applicable construction details from ANSI/ASHRAE/IESNA 90.1 Appendix A.

The code-target U-factors for skylight areas greater than 3 percent of the roof and above-grade wall fenestration areas greater than 30 percent shall be the U-factors of the surrounding opaque assembly.

C402.3.4 Area-weighted SHGC. An area weighted SHGC shall be permitted to satisfy SHGC requirements.

Reason: The proposed UA approach allows for a design heat loss rate UA approach and solar heat gain coefficient rate (SHGC) area weighted average approach to demonstrate compliance with the IECC. Currently there are no prescriptive trade-off options within the IECC for the commercial envelope. The code user can either comply with Table C402.1.2, Opaque Thermal Envelope Assembly Requirements (U-factor table), or Table C402.2 Opaque Thermal Envelope Requirements (R-value Table). The only option for flexibility is by using Section C407 Total Building Performance requirements or using an ASHRAE approach. The DOE-developed COMCheck software tool is available but this is not specifically referenced in the IECC and is allowed under C102 Alternate Materials – Method of Construction, Design, or Insulating Systems. This is the most widely used energy code compliance software in the country but is dependent on continued funding from the U.S. Department of Energy to upgrade and maintain the software.

The UA option is modeled after Section R402.1.4 Total UA Alternative in the residential provisions of the IECC. The language has been enhanced to provide more guidance for the code user on how to perform the code-target budget calculations and the proposed UA calculation. This type of calculation will allow the user flexibility without decreasing the stringency of the code. The concept has been and is currently being used in Washington State as part of their commercial building energy code.

Cost Impact: The code change proposal will not increase the cost of construction. It offers an alternative method to comply with the IECC that may actually reduce the first cost of compliance with the code because of envelope optimization.

CE87-13

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

C402.1-EC-MAKELA.doc

CE88 – 13
C402.1, C402.1.3 (NEW)

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 <u>or Section C402.1.3</u> shall be permitted as an alternative to the R-values specified in Section C402.1.1.

<u>**C402.1.3 Component performance alternative.** Building envelope values and fenestration areas determined in accordance with Equation 4-3 shall be permitted in lieu of compliance with the U-factors, F-factors and C-factors in Tables C402.1.2 and C402.3 and the maximum allowable fenestration areas in Section C402.3.1.</u>

<u>(UA Sum) + (FL Sum) + (CA Sum) + (XVG) + (XSky) $\leq$ Zero.</u> **<u>(Equation 4-3)</u>**

<u>Where:</u>

<u>UA Sum = Sum of the (UA Dif) values for each assembly that comprises a portion of the building thermal envelope.</u>
- <u>UA Dif = (UA Proposed) – (UA Table).</u>
- <u>UA Table = (Maximum allowable U-factor specified in Table C402.1.2 or Table C402.3) x (Area).</u>
- <u>UA Proposed = (Proposed U-value) x (Area).</u>

<u>FL Sum = Sum of the (FL Dif) values for each slab on grade assembly that comprises a portion of the building thermal envelope.</u>
- <u>FL Dif = (FL Proposed) – (FL Table).</u>
- <u>FL Table = (Maximum allowable F-factor specified in Table C402.1.2) x (Perimeter length).</u>
- <u>FL Proposed = (Proposed F-value) x (Perimeter length) .</u>

<u>CA Sum = Sum of the (CA Dif) values for each below-grade wall assembly that comprises a portion of the building thermal envelope.</u>
- <u>CA Dif = (CA Proposed) – (CA Table).</u>
- <u>CA Table = (Maximum allowable C-factor specified in Table C402.1.2) x (area).</u>
- <u>CA Proposed = (Proposed C-value) x (area).</u>

<u>XVG (Excess Vertical Glazing Value) = (XVGArea x UVG) – (XVGArea x UWall), but not less than zero.</u>
- <u>XVGArea (Excess Vertical Glazing Area) = (Proposed Vertical Glazing Area) – (Allowable Vertical Glazing Area deterimined in accordance with Section C402.3.1).</u>
- <u>UA Wall = Sum of the (UA Proposed) values for each opaque assembly comprising a portion of the exterior wall.</u>
- <u>UWall = UA Wall / total opaque exterior wall area.</u>
- <u>UA VG = Sum of the (UA Proposed) values for each vertical glazing assembly.</u>
- <u>UVG = UA VG / total vertical glazing area.</u>

<u>XSky (Excess Skylight Value) = (XSArea X USky) – (XSArea x U Roof), but not less than zero.</u>
- <u>XSArea (Excess Skylight Area) = (Proposed Skylight Area) – (Allowable Skylight Area determined in accordance with Section C402.3.1).</u>
- <u>UA Roof = Sum of the (UA Proposed) values for each opaque assembly comprising a portion of a roof.</u>
- <u>URoof = UA Roof / total opaque roof area.</u>
- <u>UA Sky = Sum of the (UA Proposed) values for each skylight assembly.</u>

USky = UA Sky / total skylight area.

Reason: This proposal provides an Alternative component performance path for commercial buildings parallel to the “Total UA Alternative” for residential buildings in Section R402.1.4, but accounting for slab edge F-factors, basement wall C-Factors, and fenestration areas in excess of the code limits.

This optional path provides significant additional flexibility for design teams, allowing them to trade off the U values of various building envelope components, without having to do a full Total Building Performance computation. The calculation can be done by an architect or engineer using a simple calculator. It is variation of a widely-used method in the Washington State code, and results in lower overall costs and more design freedom without any sacrifice of energy conservation.

The formula allows various envelope components to be traded off against each other, provided that the overall calculated building heat loss of the proposed design is no greater than a code-compliant design. Thus, greater window area might be acceptable with lower window U-values, or wall insulation might be reduced in certain areas while roof insulation is increased.

The five principal factors in the equation are:

- (UA Sum) The sum of the U-value for each envelope assembly times its area.
- (FL Sum) The sum of the F-value for each slab edge assembly times its length.
- (CA Sum) The sum of the C-value for each basement wall assembly times its area.
- (XSky) Additional amount for skylight area in excess of code maximum – Substitutes the average roof U-value for the average skylight U-value in the base case for the excess skylight area.
- (XVG) Additional amount for vertical glazing area in excess of maximum – Substitutes the average wall U-value for the average vertical glazing U-value in the base case for the excess vertical glazing area

Cost Impact: The code change proposal will not increase the cost of construction.

CE88-13

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

C402.1.3 (NEW)-EC-KRANZ.doc

CE89 – 13

Table C402.1.2, Table C402.2

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

Table C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS

Climate Zone	1		2		3		4		5		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-~~0.044~~ 0.041	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-~~0.031~~ 0.029	U-0.029	U-0.029	U-~~0.029~~ 0.026	U-~~0.029~~ 0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-~~0.027~~ 0.021	U-~~0.027~~ 0.021	U-~~0.027~~ 0.021	U-0.021	U-0.021	U-0.021	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-~~0.061~~ 0.048	U-~~0.061~~ 0.048
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-~~0.052~~ 0.050	U-~~0.052~~ 0.050	U-~~0.052~~ 0.050	U-~~0.052~~ 0.050	U-~~0.052~~ 0.050	U-~~0.052~~ 0.044	U-0.039	U-~~0.052~~ 0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-~~0.064~~ 0.055	U-~~0.064~~ 0.055	U-~~0.064~~ 0.049	U-~~0.057~~ 0.049	U-~~0.064~~ 0.049	U-~~0.052~~ 0.042	U-~~0.045~~ 0.037	U-~~0.045~~ 0.037
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-~~0.064~~ 0.051	U-~~0.064~~ 0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-~~0.036~~ 0.032	U-~~0.036~~ 0.032
Walls, Below Grade																
Below-grade wall	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-~~0.119~~ 0.092	C-0.119	C-~~0.119~~ 0.092	C-~~0.119~~ 0.092	C-~~0.119~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.076	U-0.076	U-~~0.076~~ 0.057	U-~~0.074~~ 0.051	U-~~0.074~~ 0.057	U-~~0.064~~ 0.051	U-~~0.064~~ 0.051	U-~~0.057~~ 0.051	U-~~0.055~~ 0.042	U-~~0.051~~ 0.042	U-~~0.055~~ 0.038	U-~~0.051~~ 0.038
Joist/framing	U-0.066	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-Grade Floors																

Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-~~0.73~~ 0.54	F-~~0.54~~ 0.52	F-~~0.54~~ 0.52	F-~~0.54~~ 0.52	F-~~0.54~~ 0 .51	F-~~0.54~~ 0.51	F-~~0.52~~ 0.434	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-~~0.55~~ 0.373

(*Footnotes not shown remain unchanged.*)

Table C402.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS

Climate Zone	1		2		3		4		5		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-30ci	R-30ci	R-~~30~~ 35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-19+ R-11 LS	R-25+ R-11 LS	R-~~25~~30+ R-11 LS	R-30+ R-11 LS	R-30+ R-11 LS	R-~~30~~ 25+ R-11+ R-11 LS	R-~~30~~ 25+ R-11+ R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-~~38~~ 49	R-~~38~~ 49	R-~~38~~ 49	R-49	R-49	R-49	R-~~49~~ 60	R-~~49~~60	R-~~49~~ 60	R-~~49~~ 60
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal Building	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-~~13~~ 19ci	R-13 + R-~~13~~ 19ci	R-13 + R-~~13~~ 19ci	R-13 + R-~~13~~ 19ci	R-13 + R-~~13~~ 19ci	R-13 + R-~~13~~ 22.1ci	R-13 + R19.5ci	R-13 + R-~~13~~ 25ci	R-13 + R-~~19.5~~ 25ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + 7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-~~7.5~~ 10ci	R-13 + R-~~7.5~~ 10ci	R-13 + R-~~7.5~~ 12.5ci	R-13 + R-~~7.5~~ 12.5ci	R-13 + R-~~7.5~~ 12.5ci	R-13 + R-15.6ci	R-13 + R-~~7.5~~ 18.8ci	R-13 + R-~~17.5~~ 18.8ci
Wood framed & other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-~~3.8~~ 7.5ci or R-20 + R-5ci	R-13 + R-7.5ci or R-20 + R-~~3.8~~ 5ci	R-13 + R-7.5ci or R-20 + R-~~3.8~~ 5ci	R-13 + R-7.5ci or R-20 + R-~~3.8~~ 5ci	R-13 + R-7.5ci or R-20 + R-~~3.8~~ 5ci	R-13 + R-7.5ci or R-20 + R-~~3.8~~ 5ci	R-13 + R-~~15.6~~ 18.8ci ~~or R-20 + R-10 ci~~	R-13 + R-~~15.6~~ 18.8ci ~~or R-20 + R-10 ci~~
Walls, Below Grade																
Below-grade wall	NR	NR	NR	NR	NR	NR	R-7.5ci	R-~~7.5~~ 10ci	R-7.5ci	R-~~7.5~~ 10ci	R-~~7.5~~ 10ci	R-~~7.5~~ 15ci	R-~~10~~ 15ci	R-~~10~~ 15ci	R-~~10~~ 15ci	R-~~12.5~~ 15ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-~~10~~ 14.6ci	R-~~10.4~~ 16.7ci	R-~~10~~ 14.6ci	R-~~12.5~~ 16.7ci	R-~~12.5~~ 16.7ci	R-~~12.5~~ 16.7ci	R-~~15~~ 20.9ci	R-~~16.7~~ 20.9ci	R-~~15~~ 23ci	R-~~16.7~~ 23ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-~~30~~ 38	R-~~30~~ 38	R-~~30~~ 38	R-~~30~~ 38	R-~~30~~ 38	R-~~30~~ 38
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24" below	R-~~10~~15 for 24" below	R-~~10~~15 for 24" below	R-~~10~~15 for 24" below	R-~~10~~ 20 for 24" below	R-~~10~~20 for 24" below	R-~~15~~20 for ~~24"~~48" below	R-~~15~~ 20 for 24" below	R-~~15~~20 for ~~24"~~48" below	R-~~15~~20 for ~~24"~~48" below	R-~~20~~25 for ~~24"~~48" below
Heated slabs	R-7.5 for 12"	R-7.5 for 12"	R-~~7.5~~ 10 for	R-~~7.5~~15 for	R-~~10~~15 for 24"	R-~~10~~15 for 24"	R-~~15~~20 for 24"	R-~~15~~20 for	R-~~15~~20 for	R-~~15~~20 for	R-~~15~~20 for	R-~~20~~ 25 for 48"	R-~~20~~25 for	R-~~20~~25 for 48"	R-~~20~~25 for 48"	R-20 ~~for 48"~~

	below	**below**	**~~12”~~24” below**	**~~12”~~24” below**	**below**	**below**	**below**	**~~24”~~48” below**	**~~36”~~48” below**	**~~36”~~48” below**	**~~36”~~48” below**	**below**	**~~24”~~48” below**	**below**	**below**	**~~below~~ full slab**

(*Footnotes not shown remain unchanged.*)

Reason: The purpose of this proposed code change is to update and increase the stringency of the opaque thermal envelope insulation tables in the *IECC* based on the values in *ANSI/ASHRAE/IES Addendum bb to ANSI/ASHRAE/IES Standard 90.1-2010* (approved in 2012). Specifically, where *IECC* values remain more stringent and energy efficient, the proposal retains the *IECC* values. Where the *ASHRAE* values are more stringent and energy efficient, those values have replaced the current *IECC* values. Since *ASHRAE 90.1* and the *IECC* use similar approaches to opaque envelope criteria, *ASHRAE 90.1* is an option for compliance under the *IECC*, and *ASHRAE 90.1* is the federal baseline commercial energy code standard, it is reasonable at this time to update *IECC* values to reflect improved *ASHRAE* values in the absence of a separate comprehensive analysis of opaque envelope values. However, where the *IECC* remains more stringent, *IECC* values should be retained to avoid backsliding and reductions in energy efficiency, in order to keep the *IECC* a premier commercial energy code.

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

CE89-13

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

C402.1.2T-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE90 – 13
Table C402.1.2, Table C402.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

Revise as follows:

TABLE C402.1.2 OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 ~~EXCEPT MARINE~~		5 ~~AND MARINE 4~~		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.048~~ 0.039	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-~~0.039~~ 0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-~~0.044~~ 0.041	U-~~0.035~~ 0.041	U-~~0.035~~ 0.041	U-~~0.035~~ 0.041	U-~~0.035~~ 0.041	U-~~0.035~~ 0.041	U-~~0.035~~ 0.037	U-~~0.035~~ 0.037	U-~~0.035~~ 0.037	U-~~0.035~~ 0.037	U-0.031	U-~~0.031~~ 0.029	U-0.029	U-0.029	U-~~0.029~~ 0.026	U-~~0.029~~ 0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-~~0.027~~ 0.021	U-~~0.027~~ 0.021	U-~~0.027~~ 0.021	U-~~0.027~~ 0.021	U-0.021	U-0.021	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017	U-~~0.021~~ 0.017
Walls, Above Grade																
Mass	U-~~0.142~~ 0.580	U-~~0.142~~ 0.151[c]	U-~~0.142~~ 0.151[c]	U-0.123	U-~~0.110~~ 0.123	U-0.104	U-0.104	U-0.090	U-~~0.078~~ 0.090	U-~~0.078~~ 0.080	U-~~0.078~~ 0.080	U-0.071	U-~~0.061~~ 0.071	U-~~0.061~~ 0.071	U-~~0.061~~ 0.048	U-~~0.061~~ 0.048
Metal building	U-~~0.079~~ 0.094	U-~~0.079~~ 0.094	U-~~0.079~~ 0.094	U-~~0.079~~ 0.094	U-~~0.079~~ 0.094	U-~~0.052~~ 0.071	U-~~0.052~~ 0.060	U-~~0.052~~ 0.050	U-~~0.052~~ 0.050	U-~~0. 052~~ 0.050	U-~~0. 052~~ 0.050	U-~~0. 052~~ 0.050	U-~~0.052~~ 0.044	U-~~0.039~~ 0.044	U-~~0.052~~ 0.039	U-0.039
Metal framed	U-~~0.077~~ 0.124	U-~~0.077~~ 0.124	U-~~0.077~~ 0.084	U-0.064	U-0.~~064~~ 077	U-0.064	U-0.064	U-0.064	U-~~0.064~~ 0.055	U-~~0.064~~ 0.055	U-~~0.064~~ 0.049	U-~~0.057~~ 0.049	U-~~0.064~~ 0.049	U-~~0.052~~ 0.042	U-~~0.045~~ 0.037	U-~~0.045~~ 0.037
Wood framed and other	U-~~0.064~~ 0.089	U-~~0.064~~ 0.089	U-~~0.064~~ 0.089	U-~~0.064~~ 0.089	U-~~0.064~~ 0.089	U-0.064	U-0.064	U-0.064	U-~~0.064~~ 0.051	U-~~0.064~~ 0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-~~0.036~~ 0.032	U-~~0.036~~ 0.032
Walls, Below Grade																
Below-grade wall[b]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-~~0.119~~ 0.092	C-0.119	C-~~0.119~~ 0.092	C-~~0.119~~ 0.092	C-~~0.19~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063	C-~~0.092~~ 0.063
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.07~~6~~4	U-0.07~~6~~4	U-~~0.076~~ 0.057	U-~~0.074~~ 0.051	U-~~0.074~~ 0.057	U-~~0.064~~ 0.051	U-~~0.064~~ 0.051	U-~~0.057~~ 0.051	U-~~0.055~~ 0.042	U-~~0.051~~ 0.042	U-~~0.055~~ 0.038	U-~~0.051~~ 0.038
Metal Joist/framing	U-~~0.066~~ 0.350	U-~~0.066~~ 0.350	U-~~0.033~~ 0.038	U-~~0.033~~ 0.038	U-~~0.033~~ 0.038	U-~~0.033~~ 0.032	U-~~0.033~~ 0.038	U-~~0.033~~ 0.038	U-~~0.033~~ 0.038	U-~~0.033~~ 0.038	U-~~0.033~~ 0.032	U-~~0.033~~ 0.032	U-~~0.033~~ 0.032	U-~~0.033~~ 0.032	U-~~0.033~~ 0.032	U-~~0.033~~ 0.032
Wood Framed and Other	U-0.282	U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.~~73~~54	F-~~0.54~~ 0.52	F-~~0.54~~ 0.52	F-~~0.54~~ 0. 520	F-~~0.54~~ 0.510	F-~~0.54~~ 0.510	F-~~0.52~~ 0.434	F-~~0.40~~ 0.510	F-~~0.40~~ 0.434	F-~~0.40~~ 0.434	F-~~0.40~~ 0.424
Heated slabs	F-~~0.70~~ 1.020	F-~~0.70~~ 1.020	F-~~0.70~~ 0.900	F-~~0.70~~ 0.860	F-~~0.70~~ 0.860	F-~~0.70~~ 0.860	F-~~0.65~~ 0.843	F-~~0.65~~ 0.688	F-~~0.58~~ 0.688	F-~~0.58~~ 0.688	F-~~0.58~~ 0.688	F-~~0.58~~ 0.671	F-~~0.55~~ 0.671	F-~~0.55~~ 0.671	F-~~0.55~~ 0.671	F-~~0.55~~ 0.373

a. Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from ANSI/ASHRAE/IES~~NA~~ 90.1 Appendix A shall be permitted, provided the construction complies with the applicable construction details from ANSI/ASHRAE/IES~~NA~~ 90.1 Appendix A.

b. Where heated slabs are below grade, below-grade walls shall comply with the *F*-factor requirements for heated slabs.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f °F.

TABLE C402.2 OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 ~~EXCEPT MARINE~~		5 ~~AND MARINE 4~~		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with ~~R-5~~ thermal blocks)[a, b]	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	~~R-19 +~~ ~~R-11 LS~~ R-10 + R-19 FC	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-25 + R-11 LS	~~R-25ci~~ R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS + R-11 LS	R-30 + R-11 LS + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	~~R-38~~ R-49	~~R-38~~ R-49	~~R-38~~ R-49	R-49	R-49	R-49	R-~~49~~ R-60	R-~~49~~ R-60	R-~~49~~ R-60	R-~~49~~ R-60
Walls, Above Grade																
Mass	~~R-5.7ci~~ NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-~~25~~ 19ci	R-~~25~~ 19ci
Metal building	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-9.8 c.i.	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-9.8 c.i	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-9.8 ci	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-9.8 ci	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-9.8 ci	~~R-13+~~ ~~R-6.5ci~~ R-0 + R-13 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-15.8 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-19 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-19 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-19 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-19 ci	~~R-13 +~~ ~~R-13ci~~ R-0 + R-19 ci	~~R-13 +~~ ~~R-13c~~ R-0 + R-22.1 ci	~~R-13+~~ ~~R-19.5ci~~ R-0 + R-22.1 ci	R-~~13~~0+ R- ~~19.5ci~~25 ci	R-~~13~~0+ R- ~~19.5ci~~25 ci
Metal framed	R-13 ~~+~~ ~~R-5ci~~	R-13 ~~+~~ ~~R-5ci~~	R-13 + R-~~5~~3.8ci	R-13 + R-7.5ci	R-13 + R-~~7.5~~ 5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + ~~R-7.5ci~~ R-10ci	R-13 + ~~R-7.5ci~~ R-10ci	R-13 + R- ~~7.5ci~~12.5 ci	R-13 + R- ~~7.5ci~~12.5 ci	R-13 + R- ~~7.5ci~~12.5 ci	R-13 + R-15.6ci	R-13 + ~~R-7.5ci~~ R-18.8ci	R-13+ ~~R17.5ci~~ R-18.8ci
Wood framed and other	R-13 ~~R-3.8ci or~~ ~~R-20~~	R-13 ~~R-3.8ci or~~ ~~R-20~~	R-13 ~~R-3.8ci or~~ ~~R-20~~	R-13 ~~R-3.8ci or~~ ~~R-20~~	R-13 ~~R-3.8ci or~~ ~~R-20~~	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R- 7.5ci ~~R-3.8ci~~ or ~~R-20u~~ R- 19 + R- 5ci	R-13 + R- 7.5ci ~~R-3.8ci~~ or ~~R-20u~~ R- 19 + R- 5ci	R-13 + R-7.5ci or ~~R-20 +~~ ~~R-3.8ci~~ R-19 + R- 5ci	R-13 + R-7.5ci or ~~R-20 +~~ ~~R-3.8ci~~ R-19 + R- 5ci	R-13 + R-7.5ci or ~~R-20 +~~ ~~R-3.8ci~~ R-19 + R- 5ci	R-13 + R-7.5ci or ~~R-20 +~~ ~~R-3.8ci~~ R-19 + R- 5ci	R-13 + R-~~15.6ci~~ 18.8ci ~~or~~ ~~R-20 + R-~~ ~~10ci~~	R-13 + R-~~15.6ci~~ 18.8ci ~~or~~ ~~R-20 + R-~~ ~~10ci~~
Walls, Below Grade																
Below-grade wall	NR	NR	NR	NR	NR	NR	R-7.5ci	~~R-7.5ci~~ R-10ci	R-7.5ci	~~R-7.5ci~~ R-10ci	~~R-7.5ci~~ R-10ci	~~R-7.5ci~~ R-15ci	~~R-10cii~~ R-15ci	~~R-10ci~~ ~~i~~R-15ci	~~R-10cii~~ R-15ci	~~R-12.5cii~~ R-15ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	~~R-10ci~~ R-14.6ci	~~R-10ci~~ R-16.7ci	~~R-10ci~~ R-14.6ci	~~R-10ci~~ R-16.7ci	~~R-12.5ci~~ R-16.7ci	~~R-12.5c~~ R-16.7ci	~~R-15cii~~ R-20.9ci	~~R-16.7cii~~ R-20.9ci	~~R-15ci~~ R-23ci	~~R-16.7ci~~ R-23ci
Metal Joist/framing	NR	NR	R-30	R-30	R-30	R-~~30~~ R-38	R-30	R-30	R-30	R-30	~~R-30~~ R-38	~~R-30~~[e] R-38	~~R-30~~[e] R-38	~~R-30~~[e] R-38	~~R-30~~[e] R-38	~~R-30~~[e] R-38
Wood Framed and Other	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38
Slab-on-Grade Floors																

CLIMATE ZONE	1		2		3		4 ~~EXCEPT MARINE~~		5 ~~AND MARINE 4~~		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24" below	~~R-10 for 24” below~~ R-15 for 24□ below	~~R-10 for 24” below~~ R-15 for 24” below	~~R-10 for 24” below~~ R-15 for 24” below	~~R-10 for 24” below~~ R-15 for 24” below	~~R-10 for 24” below~~ R-20 for 24” below	~~R-15 for 24” below~~ R-20 for 48” below	~~R-15 for 24” below~~ R-20 for 24” below	~~R-15 for 24” below~~ R-20 for 48” below	~~R-15 for 24” below~~ R-20 for 48” below	~~R-20 for 24” below~~ R-25 for 48” below
Heated slabs	R-7.5 for 12” below	R-7.5 for 12” below	~~R-7.5 for 12” below~~ R-10 for 24” below	~~R-7.5 for 12” below~~ R-15 for 24” below	~~R-10 for 24” below~~ R-15 for 24” below	~~R-10 for 24” below~~ R-15 for 24” below	~~R-15 for 24” below~~ R-20 for 24” below	~~R-15 for 24” below~~ R-20 for 48” below	~~R-15 for 36” below~~ R-20 for 48” below	~~R-15 for 36” below~~ R-20 for 48” below	~~R-15 for 36” below~~ R-20 for 48” below	~~R-20 for 48” below~~ R-25 for 48” below	R-~~20~~ 25 for ~~24~~ 48” below	R-~~20~~ 25 for 48” below	R-~~20~~ 25 for 48” below	R-20 for ~~48” below~~ full slab
Opaque Doors																
Swinging	~~U-0.61~~ U-0.70	~~U-0.61~~ U-0.50	~~U-0.61~~ U-0.70	~~U-0.61~~ U-0.50	~~U-0.61~~ U-0.70	~~U-0.61~~ U-0.50	~~U-0.61~~ U-0.50	~~U-0.61~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50	~~U-0.37~~ U-0.50
Roll-up or sliding	~~R-4.75~~ U-1.45	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50	~~R-4.75~~ U-0.50

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = *Liner System*— *Liner systems* shall have a minimum R-3 thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor ~~A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.~~

FC = *Filled Cavity – Filled Cavity* assemblies shall have a minimum R-5 thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor

a. Assembly descriptions can be found in ANSI/ASHRAE/IES~~NA~~ 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
~~e. Steel floor joist systems shall be insulated to R-38.~~

Reason: This proposal will make the fenestration requirements consistent with those published in addendum bb to ANSI/ASHRAE/IES Standard 90.1. This addendum was a result of much investigations into the cost effectiveness of various assembly types. There was also additional research done for different types of metal building assemblies. This proposal incorporates corrections to the current IECC for those building types.

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

CE90-13

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

C402.1.2T-EC-FERGUSON.doc

CE91 – 13
Table C402.1.2, Table C402.2

Proponent: Michael D. Fischer, Kellen Company, representing Polyisocyanurate Insulation Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

Table C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS

Climate Zone	1		2		3		4		5		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	U-0.048	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.039~~ U-0.032	~~U-0.039~~ U-0.032	~~U-0.039~~ U-0.032	~~U-0.039~~ U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028

(Portions of Table not shown remain unchanged)

Table C402.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS

Climate Zone	1		2		3		4		5		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~20~~ 25ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-~~25~~ 30ci	R-30ci	R-30ci	R-~~30~~ 35ci	R-35ci	R-35ci	R-35ci

(Portions of Table not shown remain unchanged)

Reason: This proposal modifies the thermal envelope requirements for above-deck roof insulation to be consistent with the recently revised ASHRAE 90.1 Addendum bb. The change is necessary to ensure that the IECC is at least as efficient as 90.1

Cost Impact: The code change proposal will increase the cost of construction. This proposal will increase the initial cost of construction, but will result in reduced energy costs that will result in a short payback.

CE91-13

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

C402.1.2T-EC-FISCHER

CE92 – 13
Table C402.1.2

Proponent: Hal Robbins, Lamtec Corporation (halr@lamtec.com)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.044	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029

(Portions of Table not shown remain unchanged)

Reason: During the development of the ANSI/ASHRAE/IES 90.1-2013, “Energy Standard for Buildings except Low-Rise Residential Buildings”, there was significant debate regarding the U-Factor associated with the thermal performance of the R-19 + R-11Ls (Liner System). The debate focused on the proposed 0.035 U-Factor for the Liner System, and related to the accuracy of this value due to the variability of the test methodology and the range of data supplied to the committee for this system. Specifically:

- The initial 0.035 U-factor was adopted for this Liner Systems based upon a single test report generated in 2007.
- In 2010 the R-19+R-11 Liner System was retested by an accredited testing laboratory, and a U-Factor of 0.039 was achieved. (a copy of the test report is attached)
- Based upon the range of values provided to the 90.1 Envelope Committee, and their understanding of the variability for this type of thermal testing, the Committee decided to adjust the U-factor being shown for the R-19+R-11 Ls from 0.035 to 0.037.

Our request to change the Metal Building Roof U-Factor being shown for the R-19+R11 Ls from 0.035 to 0.37 in Table C402.1.2 of the 2015 edition of the IECC is necessary to prevent the confusion that will arise if the U-Value assembly requirements do not agree between IECC and ASHRAE. Please keep in mind the following:

- Footnote “a” in IECC tables C402.1.2 and C402.2 references the assemblies shown in the 90.1, Table A.
- In 90.1-2013, Table A2.3 will show the U-Value for the R-19+R-11Liner Systems as 0.037
- If IECC - 2015 is not changed, it will require a U-Value of 0.035 for Climate Zones, 1 (Group R), 2, 3, 4 and 5, and there will not be a corresponding U-Value in 90.1 -Table A.
- As such, by default, the user will be driven to the next lower U-Value in the table, a far more expensive system and one that far exceeds the needs of the project.
- This request to change the U-Value for the Liner System from 0.035 to 0.037, should essentially be considered “editorial”, as the same insulation levels are being specified.

Cost Impact: This code change proposal will not increase the cost of construction. There should be no cost impact, this is strictly an editorial change.

CE92-13

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

C402.1.2T-EC-ROBBINS.doc

CE93 – 13
Table C402.1.2, Table C402.2

Proponent: Daniel J. Walker, P.E., Thomas Associates, Inc., representing Metal Building Manufacturers Association (dwalker@thomasamc.com)

Revise as follows:

Table C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Metal buildings	~~U-0.044~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	U-0.031	~~U-0.031~~ U-0.029	U-0.029	U-0.029	~~U-0.029~~ U-0.026	~~U-0.029~~ U-0.026
Walls, Above Grade																
Metal building	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.039~~ U-0.050	~~U-0.052~~ U-0.039	U-0.039

(Portions of table not shown remain unchanged)

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Metal buildings (with ~~R-5~~ thermal spacer blocks)[~~a,b~~]	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-25 + R-11 LS	~~R-25~~ R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 + R-11 LS	R-30 + R-11 + R-11 LS
Walls, Above Grade																
Metal building	~~R-13 + R-6.5ci~~ R-0 + R-9.8ci	~~R-13 + R-6.5ci~~ R-0 + R-9.8ci	~~R-13 + R-6.5ci~~ R-0 + R-9.8ci	~~R-13 + R-6.5ci~~ R-0 + R-9.8ci	~~R-13 + R-6.5ci~~ R-0 + R-9.8ci	~~R-13 + R-13ci~~ R-0 + R-13ci	~~R-13 + R-13ci~~ R-0 + R-13ci	~~R-13 + R-13ci~~ R-0 + R-15.8ci	~~R-13 + R-13ci~~ R-0 + R-15.8ci	~~R-13 + R-13ci~~ R-0 + R-15.8ci	~~R-13 + R-13ci~~ R-0 + R-19ci	~~R-13 + R-13ci~~ R-0 + R-19ci	~~R-13 + R-13ci~~ R-0 + R-19ci	~~R-13 + R-19.5ci~~ R-0 + R-19ci	R-13 + ~~R-13ci~~ R-18.8ci	R-13 + ~~R-19.5ci~~ R-18.8ci

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System – ~~A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.~~ Liner systems shall have a minimum R-3 thermal spacer block between the purlins and the metal roof panels as required, unless compliance is shown by the overall assembly U-factor

FC = Filled Cavity – Filled Cavity assemblies shall have a minimum R-5 thermal spacer block between the purlins and the metal roof panels as required, unless compliance is shown by the overall assembly U-factor

a. Assembly descriptions can be found in ANSI/ASHRAE/IES~~NA~~ 90.1 Appendix A.

~~b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2~~

(Portions of Table not shown remain unchanged)

Reason: We propose to update the roof and wall insulation requirements in the U-factor tables and corresponding R-values for consistency with the majority of the values and options found in ANSI/ASHRAE/IES 90.1-2013, "Energy Standard for Buildings Except Low-Rise Residential Buildings". Additionally, the table footnotes are proposed to be expanded to include the construction descriptions for Liner Systems and Filled Cavity assemblies.

The U-factors and R-values for roofs we propose are exactly the same as ANSI/ASHRAE/IES 90.1-2013. For walls we propose something slightly different than what was approved for 90.1-2013, but only in Climate Zones 4, 5 and 7. The values chosen for our proposal are more reasonable for metal building construction in comparison to the required performance of the other forms of construction in the tables. The values we selected also make for better transitions of the requirements from climate-zone to climate-zone, where the ASHRAE 90.1-2013 values have large jumps in the requirements between climate zones in these areas.

The reason for the large jumps in ASHRAE 90.1 was primarily due to the lack of available assemblies at the time the standard was written. By smoothing the transition for requirements between the three climate zones it provides for reasonable stringency levels and will provide for better design flexibility and alternate or innovative materials to be used.

Finally, we propose to delete the specific reference to "R-5" for the thermal spacer block requirement in Table C402.2 because the Liner System and Filled Cavity roof types utilize different thermal blocks, so a single note no longer applies. The new table footnotes contain the appropriate thermal spacer blocks for each system.

Cost Impact: The proposal will not increase the cost of construction.

CE93-13

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

C402.1.2T-EC-WALKER.doc

CE94 – 13
Table C402.1.2

Proponent: Martha G. VanGeem, representing Masonry Alliance for Codes and Standards

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, Above Grade																
Mass	~~U-0.142~~ U-0.151	~~U-0.142~~ U-0.151	~~U-0.142~~ U-0.151	U-0.123	~~U-0.110~~ U-0.123	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	~~U-0.078~~ U-0.080	U-0.071	~~U-0.061~~ U-0.071	U-0.061	U-0.061	U-0.061

(Portions of Table not shown remain unchanged)

Reason: According to Section 402.1 of the IECC, the criteria are the R-values specified in Section 402.1.1. The U-factors in Section 402.1.2 are an alternate compliance path. IECC Section 402.1.1 states that the R-values are in Tables C402.2 and C402.3. Therefore, the values in Table 402.2 are the main requirements and Table C402.1.2 lists alternates that should correspond to values in Table C402.2. Most of the mass wall criteria in both of these tables, C402.2 and C402.1.2, are based on the criteria in *ASHRAE/IES Standard 90.1-2010*.

In the last edition of the IECC, errors were introduced into Table C402.1.2 for Climate Zones 1, 2, 3, 6, and 7 for "Mass Walls, Above Grade." (Corrections to values in Climate Zone 5 are submitted in a separate proposal.)

- For Climate Zone 6, in the governing criteria table C402.2, the requirement is R-13.3ci for the row for "Mass Walls, Above Grade" and the column "Climate Zone 6, All Other." According to *ASHRAE/IES Standard 90.1-2010*, Table 5.5-6, the U-factor that corresponds to an R-value of R-13.3ci is 0.080, not 0.078.
- For Climate Zone 7, the corresponding U-factor for R-15.2ci is 0.071 not 0.061. This is shown in Table 5.5-7 of *ASHRAE 90.1-2010*. This is also demonstrated by the U-factor for Climate Zone 6 "Group R", which also has a requirement for R-15.2ci in Table 402.2 and a U-factor of 0.071 in Table 402.1.2 as shown above.
- For Climate Zone 3 "All other", the corresponding U-factor for R-7.6ci is 0.123, not 0.110. This is shown in Table 5.5-3 for Climate Zone 3 of *ASHRAE 90.1-2010.* This is also demonstrated by the U-factor for Climate Zone 2 "Group R", which also has a requirement for R-7.6ci in Table 402.2 and a U-factor of 0.123 in Table 402.1.2 as shown above.
- For Climate Zones 1 "All other" and "Group R" as well as Climate Zone 2 "All other," the corresponding U-factor for R-5.7ci is 0.151, not 0.142. This is shown in Tables 5.5-1 and 5.5-2 of *ASHRAE 90.1-2010.*

Correcting these U-factors will make the IECC less confusing and thereby simplify it and increase its use.

Therefore, the U-factors should be changed as shown in Table 402.1.2 for the row for "Mass Walls, Above Grade" for the Climate Zones 1, 2, 3, 6, and 7 to correct these errors.

Cost Impact: This code change proposal will not increase the cost of construction.

CE94-13

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

C402.1.2T #1-EC-VANGEEM.doc

CE95 – 13
Table C402.1.2

Proponent: Martha G. VanGeem, representing Masonry Alliance for Codes and Standards

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
								Walls, Above Grade								
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	~~U-0.078~~ <ins>U-0.090</ins>	~~U-0.078~~ <ins>U-0.080</ins>	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061

(Portions of Table not shown remain unchanged)

Reason: According to Section 402.1 of the IECC, the criteria are the R-values specified in Section 402.1.1. The U-factors in Section 402.1.2 are an alternate compliance path. IECC Section 402.1.1 states that the R-values are in Tables C402.2 and C402.3. Therefore, the values in Table 402.2 are the main requirements and Table C402.1.2 lists alternates that should correspond to values in Table C402.2.

In the last edition of the IECC, errors were introduced into Table C402.1.2 for Climate Zones 5 and Marine 4 for “Mass Walls, Above Grade.” In the governing criteria table C402.2, the requirement is R-11.4ci for the row for “Mass Walls, Above Grade” and the column “Climate Zones 5 and Marine 4, All Other.” This is the same criteria as for one cell to the left, “Mass Walls, Above Grade” and the column “Climate Zones 4 except Marine, Group R.” The U-factor that corresponds to an R-value of R-11.4ci is 0.090, not 0.078, as indicated by the value in “Climate Zones 4 except Marine, Group R.”

Most of the mass wall criteria in both of these tables, C402.2 and C402.1.2, are based on the criteria in *ASHRAE/IES Standard 90.1-2010*. For “All other,” the corresponding R-value in *90.1-2010* for nonresidential in Table 5.5-5 for Climate Zone 5 on page 30 is R-11.4ci and the corresponding U-factor is 0.90. Therefore the U-factor in C402.1.2 for “All other” should be 0.090 for mass walls in “Climate Zones 5 and Marine 4”. In addition, for “Group R,” the corresponding R-value in *90.1-2010* in Table 5.5-5 for Climate Zone 5 on page 30 is R-13.3ci and the corresponding U-factor is 0.80. Therefore the U-factor in C402.1.2 for “Group R” should be 0.080. These values will remain the same in *90.1-2013*. Correcting these U-factors will make the IECC less confusing and thereby simplify it and increase its use.

Therefore, in Table 402.1.2 for the row for “Mass Walls, Above Grade” and the column “Climate Zones 5 and Marine 4,” the U-factor should be changed to 0.090 for “All other” and the U-factor should be changed to 0.080 for “Group R” to correct these errors.

Cost Impact: This code change proposal will not increase the cost of construction.

CE95-13

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

C402.1.2T #2-EC-VANGEEM.doc

CE96 – 13
Table C402.1.2, Table C402.2, C402.2.5

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[c]	U-0.322	U-0.322	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051

(Portions of Table not shown remain unchanged)

a. Opaque assembly U-factors, C-factors, and F-factors from ASHRAE 90.1 Appendix A shall be permitted provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.
b. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.
c. “Mass floors” shall include floors weighing not less than:
   1. 35 psf (170 kg/m^2) of floor surface area; or
   2. 25 psf (120 kg/m^2) of floor surface area where the material weight is not more than 12 pounds per cubic foot (pcf) (1900 kg/m^3).

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Floors																
Mass[h]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R- 12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.
LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ASHRAE 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in./h-f^2 F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. Steel floor joist systems shall ~~to~~ be insulated to R-38.
a. <u>“Mass floors” shall include floors weighing not less than:</u>
   1. <u>35 psf (170 kg/m^2) of floor surface area; or</u>
   2. <u>25 psf (120 kg/m^2) of floor surface area where the material weight is not more than 12 pounds per cubic foot (pcf) (1900 kg/m^3).</u>

C402.2.5 Floors over outdoor air or unconditioned space. The thermal <u>properties (component *R*-values or assembly *U*-, *C*- or *F*-factors)</u> ~~resistance (*R*-value) of the insulating material installed either between the floor framing or continuously on the floor assembly~~ <u>of floor assemblies over outdoor air or unconditioned space</u> shall be as specified in Table <u>C402.1.2 or</u> C402.2, based on <u>the</u> construction materials used in the floor assembly.

~~“Mass floors” shall include floors weighing not less than:~~
~~1. 35 psf (170 kg/m^2) of floor surface area; or~~
~~2. 25 psf (120 kg/m^2) of floor surface area if the material weight is not more than 12 pcf (1,900 kg/m^3).~~

Reason: This public comment is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 2 open meetings and over 15 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code. Detailed reasons for this proposal are as follows:

a) This proposal moves and clarifies, but does not delete the requirements of Section C402.2.5 of the 2012 IECC.
b) In the I-Codes, text should not rely on section titles for application. Therefore, the information in the title was added to the code text.
c) The first sentence in Section C402.2.5 is revised to clarify that the provisions for floors over outdoor air or unconditioned space are also applicable to the assembly U-, C- and F-factors of Table C402.1.2.
d) The original language of Section C402.2.4 did not clearly indicate what the “mass floor” requirements were relevant or related to. These requirements are more appropriately and clearly applied as footnotes to Tables C402.1.2 and C402.2. By moving the information to the appropriate tables, unintentional non compliance will decrease (compliance will increase).

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code’s prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE96-13

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

C402.1.2T #1-EC-THOMPSON-SEHPCAC.doc

CE97 – 13

Table C402.1.2, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.~~064~~ U-0.057	U-0.057	~~U-0.064~~ U-0.052	U-0.052	U-0.045	U-0.045
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.051~~ U-0.057	~~U-0.051~~ U-0.057	~~U-0.051~~ U-0.052	~~U-0.051~~ U-0.052	~~U-0.036~~ U-0.045	~~U-0.036~~ U-0.045

(Portions of Table not shown remain unchanged)

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-19.5ci
Metal Framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 +3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-~~7.5ci~~ 3.8ci or R20 ~~+ 3.8ci~~	R-13 + R-7.5ci ~~or~~ R20 + 3.8ci; or R22	R-13 + R-7.5ci; ~~or~~ R20 + 3.8ci; or R22	R-13 + R-7.5ci; ~~or~~ R20 + 3.8ci; or R27	R-13 + R-7.5ci; ~~or~~ R20 + 3.8ci; or R27	R-13 + R-15.6ci; ~~or~~ R20 + 10ci; or R32	R-13 + R-15.6ci; ~~or~~ R20 + 10ci; or R32

(Portions of Table not shown remain unchanged.)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal is intended to correct anomalies in these tables and present additional options to increase the usability and effectiveness of the codes prescriptive building envelope requirements. Detailed reasons for this proposal are as follows:

1) Table C402.1.2
   a. In Table C402.1.2, some of the U-factors in CZ7 seem to be disjointed without reason. In the both the "Group R" and the "All Other" cells in CZ7, wood stud walls and steel stud walls have identical values except that the "All Other" cell for steel studs differs significantly. It seems reasonable to simply make all four cells values identical. Preliminary PNNL modeling has shown that merging U-factors to one performance level for all materials for building envelopes is an effective strategy for gaining more efficiency in codes. Certainly, it meets the intent of the cost effectiveness mandate from the Energy Act.
   b. In Table C402.1.2, the U-factors for both wood stud and steel stud walls are disjointed to an even greater extent than those in CZ7 or CZ8. The SEHPCAC believes that bringing these U-factors into closer alignment with each other and with adjacent climate zones makes this code more enforceable, more readily achieved and more understandable. In achieving those objectives, the SEHPCAC believes that the biggest goal, adoptability, is also achieved. Any efficiency improvement is unimportant if the model code in which it is embodied is never adopted.
   c. In the CZ8 columns of Table C402.1.2, U-factors were used that were simply in line with the descending values for the cells in CZ 1-7.
2) Table C402.2
   a. For Table C402.2 this proposal provides "cavity only" insulation options for each climate zone entry in the "Wood Framed and Other" row. This is proposed in order to provide a practical solution for energy efficiency with which builders are familiar and that they can readily execute to a satisfactory level. Buy "cavity only," it is meant that the insulation will be placed only in the cavities between studs and that c.i. (continuous insulation, such as foam insulation sheathing applied on the exterior side of studs) is not required in association with it. These "cavity only" options make compliance with, and effectiveness of, the code more likely by offering choices to designers and builders that are readily implementable.

      Please note that the cavity only insulation option is just that: it is an option. As the existing cavity plus continuous insulation (ci) options also remain in place, the cavity only options do not necessarily increase costs, they simply provide added flexibility.

      Also note that the cavity only option R-values, as minimum values, do not preclude the use of insulation with higher R-values where insulation materials are not readily available in the exact R-values provided in the Table. This is intentional. R-values differ for various insulation types and this puts all types on a level playing field. The R-values proposed for cavity only insulation Table C402.2 are derived from the U-factors for equivalent building envelope assemblies in Table C402.1.2.

      Design professionals and builders have asked ICC, Code Trainers, and other professionals "what is the option in wood framed walls for cavity only insulation." This addition provides that design flexibility and information to builders to understand the cavity only insulation requirements option. The third R-value listed in the row for wood framed wall climate zone 6 – 8, is a calculated value and may not represent thermal insulation products available off the shelf at building supply centers. Achieving the R-value in a cavity only installation may require a mix of insulation materials to achieve these values.
   b. Beginning with Climate Zones 5 and Marine 4, the second option in each cell in the "Wood Framed and Other" row has been restored to "cavity-only". In CZ5-M4, the residential cell R-values were made similar to the "All Other" cell because the U-factor values in Table C402.1.2 are the same for the corresponding table entries.
   c. The R-values in both cells of Climate Zone 6 in the "Wood Framed and Other" row were revised to reflect equivalency calculations, as performed by the American Wood Council, that were based on U-factors for corresponding entries in Table C402.1.2.

Below is the summary page of the Excel spreadsheet used to determine R-value equivalents to U-factor inputs. This is the system by which the R-values in Table C402.2 were determined from the U-factors in Table C402.1.2.

U-factor to R-value equivalency spreadsheet

Material	R	Framing Factor	25%
inside air film	0.68	Stud Path 2x4	6.30
1/2" Gyp.	0.45	Stud Path 2x6	8.80
2x4 @ 16" o.c.	4.375	Cavity - Insulation	1.92
2x6 @ 16" o.c.	6.875		
7/16" OSB	0.62		
outside air film	0.17		

Siding Type	Average Thickness	R_{siding}	Stud Size 2 x 4 Cavity Insulation R-13			Stud Size 2 x 6 Cavity Insulation R-17				
			R-13	R-15	R-17	R-17	R-19	R-20	R-22	R-24
			Wall + Siding U-factor							
			13	15	17	17	19	20	22	24
Baseline (no siding)		-	0.090	0.084	0.079	0.068	0.064	0.063	0.060	0.057
Aluminum, Steel, or Vinyl siding										
uninsulated (hollow-back)	Varies	0.62	0.084	0.079	0.075	0.065	0.061	0.060	0.057	0.055
insulated (R-2)	Varies	2.00	0.074	0.070	0.066	0.059	0.056	0.054	0.052	0.050
insulated (R-3)	Varies	3.00	0.069	0.065	0.061	0.055	0.053	0.051	0.049	0.047
Brick veneer (¾" air space)	3-5/8"	1.26	0.079	0.074	0.070	0.062	0.059	0.057	0.055	0.052
Hardboard siding	7/16"	0.67	0.084	0.078	0.074	0.065	0.061	0.060	0.057	0.055
Plywood siding (edges lapped)	3/8"	0.59	0.085	0.079	0.075	0.065	0.061	0.060	0.057	0.055
Wood siding										
Drop (8")	1"	0.79	0.083	0.078	0.073	0.064	0.061	0.059	0.056	0.054
Bevel (8", lapped)	1/2"	0.81	0.083	0.077	0.073	0.064	0.061	0.059	0.056	0.054
Bevel (10", lapped)	3/4"	1.05	0.081	0.076	0.072	0.063	0.060	0.058	0.055	0.053

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: Where the U-factors in the table are proposed to be decreased, this proposal may increase the cost of construction. Where cavity only insulation options have been provided, this proposal may decrease the cost of construction in certain applications.

CE97-13

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

C402.1.2T #4-EC-THOMPSON-SEHPCAC.doc

CE98 – 13
Table C402.1.2, Table C402.2

Proponent: Mark Halverson, APA-The Engineered Wood Association (mark.halverson@apawood.org)
Paul Coats, The American Wood Council

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal buildings	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other	U-~~0.064~~ 0.087	U-~~0.064~~ 0.087	U-~~0.064~~ 0.087	U-~~0.064~~ 0.087	U-~~0.064~~ 0.087	U-~~0.064~~ 0.087	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036

(Portions of Table not shown remain unchanged)

Table C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal buildings	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 19.5ci	R13 + 13ci	R13 + 19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + 7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R15.6ci	R-13 + R-7.5ci	R-13 + R17.5ci
Wood framed and other	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R13 + R7.5ci or R20 +R3.8ci	R13 + R7.5ci or R20 +R3.8ci	R13 + R7.5ci or R20 +R3.8ci	R13 + R7.5ci or R20 +R3.8ci	R13 + R7.5ci or R20 +R3.8ci	R13 + R15.6ci or R20 +R10ci	R13 + R15.6ci or R20 +R10ci

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

(Portions of Table not shown remain unchanged

Reason: The above-grade wall *U*-factors and the insulation requirements in Tables C402.1.2 and C402.2 are much more stringent for wood framed walls than the other framing types in Climate Zones 1-3. This proposal brings wood frame walls to levels that are within the range of the other wall types.

The code must be product neutral and not favor one product over the others. The provision of the 2012 IECC require much lower *U*-factors and greater *R*-values in Climate Zones 1-3 for above grade wood framed walls than for the other three types of walls. Codes should not unfairly provide one framing product with an advantage over another. If the goal of the IECC is to save energy, then the code should be "blind" to material types when setting performance levels.

In addition, the amount of energy saved in requiring commercial and multi-family buildings to meet a *U*-factor of 0.064 as opposed to the proposed *U*-factor of 0.087 is minimal in these warmer climate zones. When the additional cost of construction is compared to the energy savings, the provision to build at the 0.064 *U*-level is not cost effective.

Table 1 shows a *U*-factor calculation using standard *R*-values. A 7/8-inch stucco *R*-value is used instead of single-coat stucco, as is recommended when applied to wood structural panels. The 7/16-inch sheathing is used in this system as it is a typical exterior sheathing thickness for wood frame commercial walls.

This proposal works to correct those discrepancies between framing materials while bringing the Commercial IECC in-line with the Residential IECC.

We ask the support of the committee for this proposal.

Table 1. U-Factor Calculations Climate Zones 1-3, 2x4 Wood Framed Walls

Wall Thermal Resistance by Component	2x4 Wall - R13		
	R-Value Studs	**R-Value Cavity**	**Assembly Value**
Outside Air Film	0.17		
Stucco 7/8" (3-Coat)	0.18		
Continuous Insulation	0		
Wood Structural Panel Sheathing (7/16")	0.62		
Stud/Cavity Insulation	4.375	13	
Interior Gypsum	0.56		
Inside Air Film	0.68		
Studs at 16" o.c.	25%	75%	
Total Wall R-Value	6.59	15.21	**11.46**
Total Wall U-Factor	0.152	0.066	**0.0873**

Cost Impact: The code change proposal will not increase the cost of construction.

CE98-13

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

C402.1.2T #2-EC-COATS-HALVERSON.doc

CE99 – 13
Table C402.1.2, Table C402.2

Proponent: Mark Halverson, APA-The Engineered Wood Association and Paul Coats, The American Wood Council (mark.halverson@apawood.org)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal buildings	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.051~~ U-0.056	~~U-0.051~~ U-0.056	~~U-0.051~~ U-0.047	~~U-0.051~~ U-0.047	~~U-0.036~~ U-0.047	~~U-0.036~~ U-0.047

(Portions of Table not shown remain unchanged)

Table C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal buildings	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + 7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R15.6ci	R-13 + R-7.5ci	R-13 + R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 +R-3.8ci	R-13 + R-6.5~~7.5~~ci or R-18~~20~~ +R-3~~3.8~~ci or R-24	R-13 + R-6.5~~7.5~~ci or R-18~~20~~ +R-3~~3.8~~ci or R-24	R13 + R-10~~7.5~~ci or R-20 +R-5~~3.8~~ci or R-28	R13 + R-10~~7.5~~ci or R-20 +R-5~~3.8~~ci or R-28	R13 + R-10~~15.6~~ci or R-20 +R-5~~10~~ci or R-28	R-13 + R-10~~15.6~~ci or R-20 +R-5~~10~~ci or R-28

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

(Portions of Table not shown remain unchanged)

Reason: The above-grade wall *U*-factors and the insulation requirements in Tables C402.1.2 and C402.2 are much more stringent for wood framed walls than the other framing types in Climate Zones 6-8. This proposal brings wood frame walls to levels that are within the range of the other wall types as well as levels that are similar to those found in the residential energy code.

The code must be product neutral and not favor one product over the others. The provision of the 2012 IECC require lower *U*-factors and greater *R*-values in Climate Zones 6-8 for above grade wood framed walls than for the other three types of walls. Codes should not unfairly provide one framing product with an advantage over the other. Since the goal of the IECC is to save energy, it should be "blind" to framing material types when setting performance levels. This proposal works to correct those irregularities between framing materials.

Table 1 shows the *U*-factor calculations for 2x6 and 2x4 walls using a combination of continuous insulation and cavity insulation for Climate Zone 6. The 2x6 wall system uses R18 cavity insulation with R3 continuous insulation and the 2x4 systems incorporates R13 cavity with R6.5 continuous insulation. Both systems result in a *U*-factor of 0.056.

Table 2 shows a calculation for a 2x6 wall system using R24 cavity insulation. The system also incorporates 7/8-inch stucco which is recommended for direct applications to wood structural panels. The 7/16-inch sheathing is used in this system as it is a typical exterior sheathing thickness for wood frame commercial walls. This system results in a *U*-factor of 0.056 and is equivalent to the two systems found in Table 1.

Table 3 shows the *U*-factor calculations for 2x6 and 2x4 walls using a combination of continuous insulation and cavity insulation for Climate Zones 7-8. The 2x6 wall system uses R20 cavity insulation with R5 continuous insulation and the 2x4 systems incorporates R13 cavity with R10 continuous insulation. Both systems result in a *U*-factor of 0.047.

Table 4 shows a calculation for a 2x8 wall system using R28 cavity insulation. A 7/8-inch stucco *R*-value is used as is typical when applied to wood structural panels. The 7/16-inch sheathing is used in this system as it is a typical exterior sheathing thickness for wood frame commercial walls. This system results in a *U*-factor of 0.047 and is equivalent to the two systems found in Table 3.

We ask the support of the committee for this proposal.

Table 1. U-Factor Calculations Climate Zone 6 Wood Framed Walls

Wall Thermal Resistance by Component	2x6 Wall - R18+3			2x4 Wall - R13+6.5		
	R-Value Studs	R-Value Cavity	Assembly Value	R-Value Studs	R-Value Cavity	Assembly Value
Outside Air Film	0.17			0.17		
Stucco (1-Coat)	0.08			0.08		
Continuous Insulation	3			6.5		
Wood Structural Panels Sheathing	0			0		
Stud/Cavity Insulation	6.875	18		4.375	13	
5/8" Drywall	0.56			0.56		
Inside Air Film	0.68			0.68		
Studs at 16" o.c.	25%	75%		25%	75%	
Total Wall R-Values	11.37	22.49	**18.07**	12.37	20.99	**17.87**
Total Wall U-Factors	0.088	0.044	**0.0553**	0.081	0.048	**0.0559**

Table 2. U-Factor Calculations Climate Zone 6 Wood Framed Walls

Wall Thermal Resistance by Component	2x6 Wall - R24		
	R-Value Studs	R-Value Cavity	Assembly Value
Outside Air Film	0.17		
Stucco - 7/8" (3-Coat)	0.18		
Continuous Insulation	0		
Wood Structural Panels Sheathing (7/16")	0.62		
Stud/Cavity Insulation	6.875	24	
5/8" Drywall	0.56		
Inside Air Film	0.68		
Studs at 16" o.c.	25%	75%	
Total Wall R-Values	9.09	26.21	**17.81**
Total Wall U-Factors	0.110	0.038	**0.0561**

Table 3. U-Factor Calculations Climate Zones 7-8 Wood Framed Walls

Wall Thermal Resistance by Component	2x6 Wall - R20+5			2x4 Wall - R13+10		
	R-Value Studs	R-Value Cavity	Assembly Value	R-Value Studs	R-Value Cavity	Assembly Value
Outside Air Film	0.17			0.17		
Stucco (1-Coat)	0.08			0.08		
Continuous Insulation	5			10		
Wood Structural Panels Sheathing	0			0		
Stud/Cavity Insulation	6.875	20		4.375	13	
5/8" Drywall	0.56			0.56		
Inside Air Film	0.68			0.68		
Studs at 16" o.c.	25%	75%		25%	75%	
Total Wall R-Values	13.37	26.49	**21.27**	15.87	24.49	**21.56**
Total Wall U-Factors	0.075	0.038	**0.0470**	0.063	0.041	**0.0464**

Table 4. U-Factor Calculations - Climate Zones 7-8 Wood Framed Walls

Wall Thermal Resistance by Component	2x8 Wall - R28		
	R-Value Studs	R-Value Cavity	Assembly Value
Outside Air Film	0.17		
Stucco - 7/8" (3-Coat)	0.18		
Continuous Insulation	0		
Wood Structural Panels Sheathing (7/16”)	0.62		
Stud/Cavity Insulation	9.063	28	
5/8" Drywall	0.56		
Inside Air Film	0.68		
Studs at 16" o.c.	25%	75%	
Total Wall R-Values	11.27	30.21	**21.28**
Total Wall U-Factors	0.089	0.033	**0.0470**

Cost Impact: The code change proposal will not increase the cost of construction.

CE99-13

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

C402.1.2T #1-EC-COATS-HALVERSON.doc

CE100 – 13
Table C402.1.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	~~F-0.70~~ F-1.020	~~F-0.70~~ F-1.020	~~F-0.70~~ F-1.020	~~F-0.70~~ F-1.020	~~F-0.70~~ F-0.900	~~F-0.70~~ F-0.900	~~F-0.65~~ F-0.860	~~F-0.65~~ F-0.860	~~F-0.65~~ F-0.079	~~F-0.65~~ F-0.079	~~F-0.58~~ F-0.079	~~F-0.58~~ F-0.688	~~F-0.55~~ F-0.688	~~F-0.55~~ F-0.688	~~F-0.55~~ F-0.688	~~F-0.55~~ F-0.688

a. Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from ASHRAE 90.1 Appendix A shall be permitted provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.
b. Where heated slabs are below grade, below-grade walls shall comply with the *F*-factor requirements for heated slabs.

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The IECC F-factors are outdated and need to be improved. The F-factors for heated slabs in Table C402.1.2 are proposed to be revised to align with those in Tables 5.5-1 through 5.5-8 of ASHRAE 90.1-2010.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. As the maximum F-values are revised higher, which means that less insulation is required, this proposal will decrease the cost of construction.

CE100-13

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

C402.1.2T #3-EC-THOMPSON-SEHPCAC.doc

CE101 – 13
Table C402.1.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, Below Grade																
Below-grade wall [b]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass	U-0.322[d]	U-0.322[d]	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/Framing	U-0.066[d]	U-0.066[d]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033 [e]	U-0.033	U-0.033 [e]	U-0.033[e]	U-0.033[e]
Slab-on-Grade Floors																
Unheated slabs	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.65[c]	F-0.65[c]	F-0.58[c]	F-0.58[c]	F-0.58[c]	F-0.58[c]	F-0.55[c]	F-0.55[c]	F-0.55[c]	F-0.55[c]

a. Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from ASHRAE 90.1 Appendix A shall be permitted provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.
b. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.
c. Evidence of compliance with the *F-factors* indicated in the table for heated slabs shall be demonstrated by the application of the unheated slab *F*-factors and R-*values* derived from ASHRAE 90.1 Appendix A.
d. These *C*-, *F*- and *U-factors* are based on assemblies that are not required to contain insulation.

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal does not contain technical changes. Its purpose is to clarify the intent and application of the code provisions.

Detailed reasons for this proposal are as follows:

a. Reason for footnote c: Footnote c is necessary because the heated slab F-factor values in Table C402.1.2 do not match those in ASHRAE 90.1. ASHRAE 90.1 Appendix A values in Table A6.3, Assembly F-Factors for Slab on Grade Floors, reflect much higher F-factors for heated slabs with a specific R-value, as opposed to unheated slabs with the same R-value. Heated slabs lose more energy due to the input of heat directly into the slab. Therefore, more insulation is needed in a heated slab to provide the same resistance to heat loss (and therefore the same heat loss rate). IECC 2012 Table C402.1.2 heated slab F-factor values are closer to the unheated slab values in ASHRAE Appendix A. This proposal corrects Table C402.1.2 heated-slab f-factors to align with 90.1 Appendix A. If using the 2012 Table 402.1.2, correlating the IECC F-factor to an equivalent R-value via ASHRAE Appendix A, would require significantly more insulation than the IECC prescriptive R-value. Example: Heated slab in Climate Zone 3, per C402.1.2 requires an F-factor of F-0.70, or a prescriptive R-10 for 24" below. In the 90.1-2010 Appendix A tables, an equivalent to F-0.70 for heated slabs would require R-20 for 48" below, doubling the prescriptive IECC R-value and depth. The existing C402.12 F-factors for Climate Zones 5 and higher correlate to ASHRAE Appendix A insulation levels that prohibit the use of slab edge insulation; only a fully insulated slab can meet the F-0.58 or lower (derived from Table C402.1.2 and correlated to 90.1). Whereas the most restrictive slab edge R-value via IECC prescriptive tables is R-20 for 48" below. ASHRAE's best slab edge F-factor is for R-30 for 48" below (only F-0.659).

b. Footnote "d" has been added to clarify that all specific C-, F- and U-factors that are followed by the "d" superscript are factors for assemblies that do not contain insulation. Note that Table C402.2 indicates "NR" (Not Required) for all equivalent applications. This will save time for users by not requiring them to go to ASHRAE 90.1 Appendix A to verify for themselves that the end result is that no insulation is required in these scenarios.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE101-13

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

C402.1.2T #2-EC-THOMPSON-SEHPCAC.doc

CE102 – 13
Table C402.1.2, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings[d]	U-0.044	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other[c]	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building[d]	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed[f]	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other[e]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, Below Grade																
Below-grade wall[b]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/Framing	U-0.066	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033 [e]	U-0.033	U-0.033 [e]	U-0.033[e]	U-0.033[e]
Slab-on-Grade Floor																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55

a. ~~Use of~~ Prescriptive opaque assembly *U*-factors, *C*-factors, and *F*-factors from ASHRAE 90.1 Appendix A shall be permitted to be used to show evidence of compliance with this table, provided the construction complies with the applicable construction details, including insulation component thermal requirements, from ASHRAE 90.1 Appendix A.

b. Where heated slabs are below grade, below-grade walls shall comply with the *F*-factor requirements for heated slabs.
c. Attic insulation and all other types of roof insulation other than above deck or metal building insulation.
d. Metal skin and steel-framed structural system wherein the insulation, other than continuous insulation, is often compressed at the areas between the structural members and the metal skin.
e. Wood light framed walls and all other wall systems except mass walls, metal building walls and metal framed walls.
f. Light framed walls where the insulation, other than continuous insulation, is installed in the cavity between metal framing members.

TABLE ~~C402.2~~ C402.1.1
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM R-VALUE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation Entirely Above Roof Deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal Buildings (with R-5 thermal blocks)[a,b]	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-25 + R11 LS	R-25 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS
Attic and other[a]	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R–49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building[b]	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-19.5ci
Metal Framed[f]	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other[e]	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 +3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-15.6ci or R20 + 10ci	R-13 + R-15.6ci or R20 + 10ci
Walls, Below Grade																
Below Grade Wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R- 12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist / Framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab on Grade Floor																
Unheated Slabs	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated Slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-20 for 48 in. below	R-20 for 24 in below	R-20 for 48 in below	R-20 for 48 in below	R-20 for 48 in below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.
LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

a. ~~Assembly descriptions can be found in ASHRAE 90.1 Appendix A~~. "Attic and other" is attic insulation and all other types of roof insulation other than above deck or metal building insulation.
b. Buildings that incorporate a metal skin and steel-framed structural system wherein the insulation is often compressed between the skin and framing members. Where using the *R*-value compliance method, a thermal spacer block is required between the skin and framing members, otherwise use the assembly *U*-factor compliance method in Section C402.1.2 and Table C402.1.2.
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in./h-f^2 F.
d. Where heated slabs are below grade, below-grade walls shall comply with the *F*-factor requirements for heated slabs.
e. Wood light framed walls and all other wall systems except mass walls, metal building walls and metal framed walls.
f. Light framed walls where the insulation, other than continuous insulation, is installed in the cavity between metal framing members~~.~~

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal clarifies the code and increases its usability with regard to Tables C402.1.2 and C402.2 and the code's prescriptive building thermal envelope provisions. It does not contain technical changes. Most of these changes clarify the relationship between the tables and ASHRAE 90.1 Appendix A, eliminate the need to go to ASHRAE Appendix A, or add missing information regarding how ASHRAE 90.1 Appendix A is to be used when it is necessary to use it. An effort was also made to coordinate the footnotes between Tables C402.1.2 and C402.2.

Detailed reasons for this proposal are as follows:

1) Table C402.1.2:
   - **a.** Revised Footnote a: The existing language indicates that ASHRAE 90.1 Appendix A is permitted to be used, but it does not state what it is to be used for. This proposal clarifies that the purpose is to "show evidence of compliance with this table" and that the design must then also comply with Appendix A "insulation component thermal requirements."
   - **b.** Footnote b: unchanged
   - **c.** Proposed new Footnote c: This new footnote indicates what "Attic and other" is intended to apply to as used in the table, which is "insulation other than above deck or metal building insulation ." Members of SEHPCAC subgroup working on this proposal verified this information with Steve Ferguson of ASHRAE. This information is necessary as building officials have reported that many users call and ask what "Attic and other" is.
   - **d.** Proposed new Footnote d: This footnote describes what the term "Metal buildings" is intended to mean as used in the table. Previously it was necessary to go to ASHRAE 90.1 for this information, making the use of the table cumbersome and incomplete. This description is based upon the ASHRAE 90.1 description.
   - e. New Footnote e: This new footnote clarifies that the term "Wood framed and other," as used in the table, "are wood framed walls and all other wall systems except mass walls, metal building walls and metal framed walls." There is much confusion in the field as to how this term is to be interpreted.
   - f. Proposed new Footnote f: This new footnote describes what the term "Metal framed walls" is intended to mean as used in the table. Previously it was necessary to go to ASHRAE 90.1 for this information, making the use of the table cumbersome and incomplete. This description is based upon the ASHRAE 90.1 description.
2) Table C402.2:
   - a. Revised Footnote a: Rather than forcing the user to go to ASHRAE 90.1 for a description of assemblies, the footnotes have been revised to include the necessary descriptions. Footnote a in particular now describes the term ""Attic and other" as used in the table, which is "insulation other than above deck or metal building insulation." Members of SEHPCAC subgroup working on this proposal verified this information with Steve Ferguson of ASHRAE. This information is needed as building officials have reported that many users call and ask what "Attic and other" is.
   - **b.** Revised Footnote b: In addition to retaining the information related to "spacer blocks," this footnote now also describes what the term "Metal buildings" is intended to mean as used in the table. Previously it was necessary to go to ASHRAE 90.1 for this information, making the use of the table cumbersome and incomplete. This description is based upon the ASHRAE 90.1 description.
   - c. Footnote c: unchanged
   - **d.** Footnote d: unchanged

e. New Footnote e: Identical to proposed Footnote e to Table C402.1.2, this new footnote clarifies that the term “Wood framed and other,” as used in the table, “are wood framed walls and all other wall systems except mass walls, metal building walls and metal framed walls.” There is much confusion in the field as to how this term is to be interpreted.

f. Proposed new Footnote f: Identical to proposed Footnote f to Table C402.1.2, this new footnote describes what the term “Metal framed walls” is intended to mean as used in the table. Previously it was necessary to go to ASHRAE 90.1 for this information, making the use of the table cumbersome and incomplete. This description is based upon the ASHRAE 90.1 description.

g. Note that, although some of the new footnotes proposed are definitions, and definitions typically belong in Chapter 2, since these definitions pertain only to the these terms as used in this table (they are not used elsewhere in the code), their proper place is as footnotes to the table.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code’s prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE102-13

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

C402.1.2T #5-EC-THOMPSON-SEHPCAC.doc

CE103 – 13
C402.1.1, C402.1.2, C402.2.7, Table C402.1.2, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. ~~The~~ *Building thermal envelope* opaque assemblies shall meet the requirements of Tables C402.2 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1. Doors having less than 50 percent glass area shall be considered opaque doors. Opaque swinging doors shall comply with Table C402.1.2 and opaque roll-up or sliding doors shall comply with Table C402.1.1.

C402.1.2 *U*-factor alternative. An opaque assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2. Doors having less than 50 percent glass area shall be considered opaque doors. Opaque swinging doors shall comply with Table C402.1.2 and opaque roll-up or sliding doors shall comply with Table C402.1.1.

~~**C402.2.7 Opaque doors.** Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors as specified in Table C402.2 and be considered as part of the gross area of above-grade walls that are part of the building envelope.~~

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37

(Portions of Table not shown remain unchanged)

TABLE C402.2
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Opaque Doors																
~~Swinging~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

a) This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code.

b) The information related to opaque doors in the code is confusing. Doors are only found in Table C402.2 which is supposed to be the table addressing R values. But R-values are only provided for roll-up and sliding doors, but not for swinging doors. For swinging doors it provides a U-factor. U-factors are commonly listed in Table C402.1.2, but this latter table has no provisions for doors.

c) This proposal moves the U-factor information for swinging doors to the U-factor table, but leaves the R-values for Roll-up or sliding doors in the R-value table (C402.2). It also and adds language to the text of Sections C402.1.1 and C402.1.2 that directs users from one table to the other for the information related to opaque doors that is not contained in each respective table. (i.e., Section C402.1.1 is revised to direct users to Table C402.1.2 for opaque swinging door thermal information and Section C402.1.2 has been revised to direct users to Table C402.2 for opaque roll-up or sliding door thermal requirements.

d) The opaque door requirements of existing Section C402.2.7of the 2012 IECC are directly related to the application of Sections C402.1.1 and C402.1.2 and their associated tables. The current scenario, however, is disjointed as there is no direct connection in Sections C402.1.1 or C402.1.2 to Section C402.2.7. Therefore, users are often unaware of the connection. As a result of the current disjointed arrangement of the opaque door provisions, Section C402.7 tends to be overlooked. This proposal clarifies the relationship by moving (not deleting) the information related to opaque doors from Section C402.2.7 directly into the sections they are related to: Sections C402.1.1 and C402.1.2.

e) With the R-value and U-factor information relegated to the proper tables by this proposal, it clears the way for the titles to be revised to clearly indicate their proper application. The existing text titles do not indicate a) which method they are associated with or b) whether the values in the tables are intended to be applied as maximum or minimum values. Furthermore, while Table 402.1.2 appropriately indicates that it applies to assemblies, Table C402.2 does not indicate whether it is applicable to entire assemblies or to insulation components. Therefore, this proposal:

a. Revises the title of Table C402.1.2 to indicate that it contains *maximum* requirements, while the title of Table C402.2 is revised to indicate that it contains *minimum* requirements. This information differs for each table, is not intuitive to all users (many users incorrectly assume both tables contain maximum values) and is critical to the proper application of these tables.

b. Adds "R-VALUE METHOD" to the title of Table C402.2 and "U-FACTOR METHOD" to the title of Table C402.1.2. This reinforces the proper application of the tables with their respective methods. Note that existing Footnote "b" to Table C402.2 describes these methods in exactly this way.

c. Adds the words "insulation component" to the title of Table C402.2 in order to further clarify its application. Once again, unlike Table 401.1.2, Table C402.2 is not applicable to entire assemblies.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE103-13

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

C402.1.1 #3-EC-THOMPSON-SEHPCAC.doc

CE104 – 13
Table C402.1.2, Chapter 5

Proponent: Mark Nowak, M. Nowak Consulting LLC, representing Steel Framing Alliance

Revise as follows:

TABLE C402.1.2
OPAGUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a, b]

a. Use of Opaque assembly U-factors, C-factors, and F-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted, provided the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Opaque assembly U-factors based on designs tested in accordance with ASTM C1363 shall be permitted. Modifications to the test results shall be permitted based on the addition or subtraction of building components on the exterior of the framing of the original tested design.
~~b.~~ c. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 5 as follows:

ASTM

ASTM C 1363-11 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

Reason: This proposal accomplishes three objectives. First it clarifies that one can use the ASHRAE 90.1 Appendix A U-Factors for compliance even if the siding system differs from the stucco siding system assumed in 90.1. The R-value of stucco is insignificant (approximately R 0.08) and choice of other siding should not disallow use of the 90.1 Appendix tables. For many assemblies, 90.1 is the only source of U-factors. This proposal will broaden their use without any significant impact on energy use.

Second, this proposal recognizes results of hot box laboratory tests conducted in accordance with ASTM C1363 for compliance with the code. Tested assemblies represent the best available data for assemblies and they should be recognized as acceptable for compliance.

Third, the proposal recognizes that hot box tests are costly and time consuming and it is not feasible or necessary to test every possible configuration but only the base assembly. A base assembly consists of the wall framing and cavity insulation with or without interior gypsum board or exterior sheathing. The U-factor of assemblies that differ from the base assembly in terms of different claddings, exterior continuous insulation, and sheathings can be calculated by adding or subtracting component R-values as long as changes are not made to the framing factor or the R-value of the cavity insulation.

The proposed test standard can be viewed by the committee through the ASTM website set up specifically to facilitate review of proposals to the ICC codes.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM C 1363-2011 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE104-13

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

C402.1.2T-EC-NOWAK.doc

CE105 – 13
C402.2, C402.2.1 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.2 Specific building thermal envelope insulation requirements (Prescriptive). ~~Opaque assemblies shall comply with Table C402.2.~~ Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.8 and Table C402.2.

C402.2.1. Multiple layers of continuous insulation board. Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. If the continuous insulation board manufacturer's installation instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

a) This proposal clarifies the application of these sections and makes no technical changes.
b) The intent of the code is that the provisions of Section C402.2 and its subsections are to apply to both of the code's prescriptive building thermal envelope methods (the R-value and U-factor methods), not just the R-value method indicated in the existing text by its reference solely to Table C402.2.
c) In addition, this proposal breaks out the specific requirement for continuous insulation into a separate subsection, which agrees conceptually with the format of the other current subsections of Section C402.2.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE105-13

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

C402.2-EC-THOMPSON-SEHPCAC

CE106 – 13

Table C402.2, C402.2.3

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Walls, Above Grade																
Mass[f, g]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-19.5ci
Metal Framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other[f]	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 +3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-15.6ci or R20 + 10ci	R-13 + R-15.6ci or R20 + 10ci
Walls, Below Grade																
Below Grade Wall[d, f]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.
LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ASHRAE 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. Steel floor joist systems shall be insulated to R-38.
f. The R-value of integral insulation installed in concrete masonry units shall not be used in determining compliance with Table C402.2.
g. "Mass walls" shall include walls weighing not less than:
   1. 35 psf (170 kg/m^2) of wall surface area; or
   2. 25 psf (120 kg/m^2) of wall surface area where the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).

~~**C402.2.3 Thermal resistance of above-grade walls.** The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.~~

~~"Mass walls" shall include walls weighing not less than:~~

~~1. 35 psf (170 kg/m^2) of wall surface area; or~~
~~2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).~~

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal is intended to clarify the use and application of the codes prescriptive building thermal envelope provisions and does not contain changes to the technical requirements of the code. Detailed reasons are as follows:

a) The first sentence in Section C402.2.3 is unnecessary as it is redundant with the requirements of Section C402.1.1 and Table C402.2. It appears to be there only to tie these provisions to Section C402.1.1. Thus, it is better to simply relocate these provisions in Section C402.1.1. The current scenario also creates a condition wherein these redundant requirements could unintentionally diverge in the future.
b) The second sentence and the "Mass wall" criteria in Section C402.2.3 are directly related to Table C402.1.1 and, therefore, are more appropriately located as footnotes to the table. While using the table in its current form (without these proposed footnotes), it is difficult to tell that these provisions are relevant to it.
c) As currently organized, it is not apparent to users as they apply Tables C402.1.1 and C402.2 that Section C402.2.3 is applicable to the tables. This change makes the application more obvious and, therefore, will increase compliance.
d) Note that the requirements of Section C402.2.3 are being moved, not deleted.
e) Note that the provisions of C402.2.3 that are being moved are not requirements, they simply indicate how the term "mass walls" is intended to be applied in the tables.

The SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE106-13

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

C402.2T-EC-THOMPSON-SEHPCAC

CE107 – 13
Table C402.2

Proponent: Mark Nowak, M. Nowak Consulting, LLC, representing Steel Framing Alliance

Revise as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2	
	All other	Group R	All other	Group R
Walls, Above Grade				
Metal Framed	R-13~~+5ci~~	R-13~~+5ci~~	R-13~~+5ci~~	R-13~~+ 7.5 ci~~
Wood framed and other	R-13~~+3.8 or R-20~~	R-13+~~3.8 or R-20~~	R-13~~+3.8 or R-20~~	R-13+~~3.8 or R-20~~

(Portions of Table not shown remain unchanged)

Reason: The addition of continuous insulation for Climate Zones 1 and 2 in the 2009 and 2012 code resulted in significant construction costs but little energy savings. Further, in these warmer climates, the embodied energy to manufacture and ship the continuous insulation requires years of the annual projected savings before any real energy savings occurs. Energy conservation could be better accomplished in other areas of the building where more energy could be conserved for each dollar invested.

Following is an analysis of Group R construction that was conducted in various cities from Climate Zones 1 and 2. The data shows the costs and benefits associated with specifying a metal framed wall with and without continuous insulation. The selected cities are the representative cities developed by the US Department of Energy's Pacific Northwest National Laboratory (PNNL) for these respective climate zones. Based on this analysis, which shows simple paybacks from 30 to 102 years, there is not sufficient justification to retain the insulation requirements at the current levels.

Climate zone	City	Building energy use with R-13 exterior walls (kWh)	Building energy use with R13+5 exterior walls (kWh)	Building Energy with R13+7.5 (kWh)	Annual energy savings with addition of continuous insulation (kWh)/$	Cost of continuous insulation per building ($)	Payback in years
1	Miami	373033	371739	-	1294/$138	14032	102
2	Houston	389323	-	384992	4331/$537	16533	31
2	Phoenix	384175	-	380105	4070/$472	16533	35

Table Notes: Energy use was determined through simulations with Energy Gauge Summit V4.10 for a four story 32 unit multi-family apartment based on minimum prescriptive and equipment requirements in the 2012 IECC. Energy costs are as reported year end 2011 by USEIA for the largest utility providers in each city. Insulation costs are national averages from Craftsman Estimator 2007 adjusted for inflation and contractor overhead and profit.

In addition to the lengthy payback periods in these climate zones, the consideration of embodied energy needs to be addressed. The table below shows the embodied energy impact on the overall payback period. In Phoenix and Houston, it will take approximately 7 years before any overall energy will be saved compared to a wall without continuous insulation. The payback for embodied energy increases to 15 years in Miami. When added to the payback for first costs, this will put the overall payback period between 42 and 117 years for the cities in these climate zones, well outside accepted norms.

Climate zone	City	Embodied energy for R-5 continuous insulation (kWh)	Embodied energy for R-7.5 continuous insulation (kWh))	Annual energy savings with addition of continuous insulation (kWh)	Years to payback embodied energy
1	Miami	19388	-	1294	15
2	Houston	-	29030	4331	6.7
2	Phoenix	-	29030	4070	7.1

Table notes: Embodied energy information based on 1.87 kWh per SF or R-5 insulation. Source of embodied energy data extracted from Environmental Building News (Wilson 2010 downloaded from http://www2.buildinggreen.com/blogs/avoiding-global-warming-impact-insulation on December 4, 2012)

Cost Impact: The code change proposal will not increase the cost of construction.

CE107-13

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

C402.2T-EC-NOWAK.doc

CE108 – 13
Table C402.2

Proponent: Larry Williams, Steel Framing Industry Association

Revise as follows:

Table C402.2
Opaque thermal Envelope requirements

Climate Zone	3	
	All other	**Group R**
	Walls, above grade	
Metal Framed	R-13~~+7.5ci~~	R-13~~+7.5ci~~
Wood framed and other	R-13+~~3.8 or R-20~~	R-13+~~3.8 or R-20~~

(Portions of Table not shown remain unchanged)

Reason: The addition of continuous insulation for Climate Zone 3 in 2009 and its further increase in the 2012 code resulted in significant construction costs but little energy savings. Further, the embodied energy to manufacture and ship the continuous insulation requires years of the annual projected savings before any real energy savings occurs. Energy conservation could be better accomplished in other areas of the building where more energy could be conserved for each dollar invested.

Following is an analysis of Group R construction that was conducted in various cities from Climate Zone 3. The data shows the costs and benefits associated with specifying a metal framed wall with and without continuous insulation. The selected cities are the representative cities developed by the US Department of Energy's Pacific Northwest National Laboratory (PNNL) for this climate zone. Based on this analysis, which shows simple paybacks from 23 to 25-1/2 years, there is not sufficient justification to retain the insulation requirements at the current levels.

Climate zone	*City*	*Building energy use with R-13 exterior walls (kWh)*	*Building Energy with R13+7.5 (kWh)*	*Annual energy savings with addition of continuous insulation (kWh)/$*	*Cost of continuous insulation per building ($)*	*Payback in years*
3	*El Paso*	*399359*	*393888*	*5471/$649*	*16533*	*25.5*
3	*San Francisco*	*355492*	*351170*	*4322/$662*	*16533*	*25*
3	*Memphis*	*439907*	*432413*	*7494/$718*	*16533*	*23*

Table Notes: Energy use was determined through simulations with Energy Gauge Summit V4.10 for a four story 32 unit multi-family apartment based on minimum prescriptive and equipment requirements in the 2012 IECC. Energy costs are as reported year end 2011 by US EIA for the largest utility providers in each city. Insulation costs are national averages from Craftsman Estimator 2007 adjusted for inflation and contractor overhead and profit.

In addition to the lengthy payback period in these climate zones for first costs, the consideration of embodied energy needs to be addressed. The table below shows the embodied energy payback periods. The embodied energy increases payback by approximately 4 to just under 7 additional years. When added to the payback for first costs, this will put the overall payback period between approximately 27 and 32 years, well outside accepted norms.

Climate zone	*City*	*Embodied energy for R-7.5 continuous insulation (kWh))*	*Annual energy savings with addition of continuous insulation (kWh)*	*Years to payback embodied energy*

1	*El Paso*	*29030*	*5471*	*5.3*
2	*San Francisco*	*29030*	*4322*	*6.7*
2	*Memphis*	*29030*	*7494*	*3.9*

Table notes: Embodied energy information based on 1.87 kWh per SF or R-5 insulation. Source of embodied energy data extracted from Environmental Building News (Wilson 2010, downloaded from http://www2.buildinggreen.com/blogs/avoiding-global-warming-impact-insulation on December 4, 2012)

Cost Impact: The code change proposal will not increase the cost of construction.

CE108-13

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

C402.2T-EC-WILLIAMS.doc

CE109 – 13
Table C402.2

Proponent: Robert A. Zabcik, NCI Building Systems, representing self

Revise as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE	
	All Other	**Group R**	**All Other**	**Group R**	**All Other**	**Group R**	**All Other**	**Group R**
ROOFS								
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci
Metal Buildings ~~(with R-5 thermal blocks)~~[a,b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.
LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

Reason: The purpose of this proposal is to correct an error. The requirement of R-5 thermal blocks for the referenced assemblies is not correct. According to Appendix A of ASHRAE 90.1-2010 (as referenced in footnote a and as qualified in Chapter 5 of the Commercial Provisions of IECC) the reference liner system has a minimum R-3.5 thermal block. Rather than change the table to reflect R-3.5, it is proposed to eliminate the statement completely since the thermal block requirement is very clearly stated in the 90.1 Appendix already. To repeat the requirement in this table further introduces a maintenance issue, especially considering the fact that many state codes incorporate this table verbatim. This has caused a problem in the North Carolina energy code, for instance. For convenience, the pertinent ASHRAE 90.1 Appendix A passage is repeated below and the R factor requirement bolded:

> **A2.3.2.4 *Liner System* (Ls).** A continuous vapor barrier liner is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the liner between the purlins. For multilayer installations, the first *rated R-Value of insulation* is for unfaced insulation draped over purlins and then compressed when the metal *roof* panels are attached. A minimum **R-3.5**. thermal spacer block between the purlins and the metal *roof* panels is required when specified in Table A2.3.

Cost Impact: The code change proposal will not increase the cost of construction. This to correct an error.

CE109-13

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

C402.2T-EC-ZABCIK.doc

CE110 – 13
Table C402.2

Proponent: Mark Halverson, APA-The Engineered Wood Association (mark.halverson@apawood.org), Paul Coats, The American Wood Council

Revise as follows:

Table C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal buildings	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R13 + 13ci	R-13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 19.5ci	R13 + 13ci	R13 + 19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + 7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R15.6 ci	R-13 + R-7.5ci	R-13 + R17.5 ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R3.8~~7.5~~ci or R20 ~~+R3.8 ci~~	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R15.6 ci or R20 +R10ci	R13 + R15.6 ci or R20 +R10ci

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. Steel floor joist systems shall be insulated to R-38.

(Portions of Table not shown remain unchanged)

Reason: The above-grade wall *U*-factors and the insulation requirements for Climate Zone 5 and Marine 4 in Tables C402.1.2 and C402.2 are in alignment, except for the *R*-value requirements for Group R buildings. This proposal simply brings those insulation values into alignment with the other *R*-values and *U*-factors for the climate zone. Since each of the other climate zones have consistent wood frame wall *R*-values and *U*-factors for “Group R” buildings and “All Other” buildings, it only makes sense to correct the inconsistency found in this cell in Table C402.2.

Cost Impact: The code change proposal will not increase the cost of construction.

CE110-13

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

C402.2T-EC-COATS-HALVERSON.doc

CE111 – 13
Table C402.2

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

Revise as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 except Marine		5 & Marine 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
~~Roll-up or sliding~~ <u>Non-swinging</u>	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

(Portions of Table not shown remain unchanged)

Reason: "Non-swinging" is a better term to use since it not only would distinguish these types of doors from "swinging doors", but the term encompasses sectional garage doors as well as rolling ("roll-up") doors and sliding doors. "Non-swinging" is also used in ASHRAE 90.1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE111-13

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

C402.2T-EC-HETZEL.doc

CE112 – 13

C402.2.1, C402.2.1.1 (NEW), C402.2.1.2 (NEW), C402.2.1.3

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.2.1 Roof ~~assembly~~ insulation. Roof insulation shall comply with Sections C402.2.1.1, C402.2.1.2 and C402.2.1.3.

C402.2.1.1 Variations in continuous roof insulation thickness. ~~The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly.~~ Where the thickness of continuous above deck roof insulation varies by 1 inch (25 mm) or less:

1. For designs intended to comply with Section C402.1.1, the area-weighted *R*-value shall be not less than the *R*-value specified in Table C402.2, or
2. For designs intended to comply with Section C402.1.2, the area-weighted *U*-factor shall not be greater than the *U*-factor specified in Table C402.1.2.

C402.2.1.2 Insulation at skylight curbs. Skylight curbs shall be insulated to not less than the level ~~of~~ required for roofs with insulation entirely above deck or *R*-5, whichever is less.

Exception~~s~~:

~~1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.~~

~~2.~~ 1. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

C402.2.1.3 Suspended ceiling insulation. Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

Reason: This public comment is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 2 open meetings and over 15 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal seeks to clarify the code's provisions related to roof insulation by essentially breaking the provisions out into 3 separate subsections. This proposal makes no technical changes. Detailed reasons are as follows:

a) The first sentence in the original provision was removed as it was redundant with information already contained in Section C402.1.1. This information appeared to be repeated in Section C402.2.1 of the 2012 IECC solely to facilitate the application of Exception 1. However, it is not an exception. It is an alternative requirement. As such, it was reconfigured as Item 2 to proposed new Section C402.2.1.1.
b) The main/parent section title was revised to include the word "insulation" and delete the word "assembly," which is more indicative of what this section is applicable to.
c) The area weighting provisions were broken out into their own subsection and the language was revised so that the concept can now be applied to both the R-value and U-factor methods in Tables C402.1.1 and C402.1.2. Formerly, these provisions only applied to Table C402.2.
d) The skylight insulation component was broken out to add clarity.
e) The suspended ceiling insulation component was broken out to add clarity.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE112-13

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

C402.2.1-EC-THOMPSON-SEHPCAC

CE113 – 13
C402.2.1

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. <u>Where continuous insulation boards are used with insulation entirely above deck, the insulation boards shall be installed in two or more layers with the insulation board joints staggered and offset between each layer.</u> Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.
2. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

Reason: This code change proposal is intended to add a requirement for insulation boards used in roof assemblies in insulation above deck configurations to be installed in two or more layers allowing for staggering and offsetting the board joints. This installation method will improve the effective thermal performance of the roof assembly by effectively reducing heat loss through the board joints.

Cost Impact: This code change proposal will not increase the cost of construction.

CE113-13

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

C402.2.1 #1-EC-GRAHAM.doc

CE114 – 13
C402.2.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.
2. Unit skylight curbs included as a component of ~~an NFRC 100 rated assembly~~ a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

Reason: The term "rated" is generally understood but the correct presentation of the criterion is that the assembly be listed and labeled in accordance with NFRC 100. This proposal clarifies when a skylight curb can be exempted from meeting the requirements for insulating the curb.

Cost Impact: The code change proposal will not increase the cost of construction.

CE114-13

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

C402.2.1-EC-WILLIAMS.doc

CE115 – 13
C402.2.1

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.
2. <u>Where tapered insulation is used with insulation entirely above deck, the *R*-value where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the *R*-value specified in Table C402.2</u>

~~2~~ <u>3</u>. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

Reason: This code change proposal is intended to clarify the Code's intent how R-value is determined when using slope-to-drain tapered insulation systems in roof assemblies using the insulation entire above deck configuration.
The *2012 IECC Code and Commentary* indicates Exception 1 is intended to address tapered insulation systems in insulation entire above deck configurations. The Commentary's text on this specific topic is as follows:

> "The exception to this section permits a roof that is "continuously insulated" to have areas that do not meet the required *R*-values, provided that the area weighted values are equivalent to the specified insulation values. This type of insulation referred to as a tapered installation is where the roof insulation thickness varies to provide slope for drainage. Therefore, while one section may have less insulation due to this slope, other portions of the roof would be above the values required. Therefore, in this situation the weighted average of the insulation would meet the required values even though some portions may be less than that specified in Table C402.2. When applying the exception, it is important to notice that the variation in insulation thickness is limited to 1 inch (25 mm). This limitation on the thickness variation will help ensure more consistent insulation coverage and also reduce the number of roofs that qualify to use this exception.
>
> This 1-inch (25 mm) limitation does not prevent the provisions from being applied to roofs that have a greater variation; it simply does not allow additional thickness to be factored into the average insulation values. Where the variation exceeds 1 inch (25 mm), it would be permissible to go to the thinnest spot and measure the *R*-value at that point (for the example call this Point "a"). Then go to a point that is 1 inch (25 mm) thicker than Point "a" and measure the *R*-value there (for the example, call this Point "b"). The remaining portions of the roof that are thicker than that additional 1-inch (25 mm) portion (Point "b") would simply be assumed to have the same *R*-value that Point "b" had. All portions of the roof that meet or exceed the Point "b" *R*-value would simply use the Point "b" *R*-value when determining the area weighted *U*-factor for the roof."

Simply put, this is confusing.

The proposed new Exception 2 is an attempt to provide clearer, more concise wording addressing tapered insulation systems in roof assemblies using the insulation entire above deck configuration.

This proposal keeps the existing Exception 1 intact as it may apply to situations other than tapered insulation systems in roof assemblies using the insulation entire above deck configuration.

Cost Impact: The code change proposal will not increase the cost of construction.

CE115-13

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

C402.2.1 #2-EC-GRAHAM.doc

CE116 – 13
C402.2.1.1

Proponent: Amy Dickie, Global Cool Cities Alliance (amy@globalcoolcities.org)

Revise as follows:

C402.2.1.1 Roof solar reflectance and thermal emittance. Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal, directly above cooled *conditioned spaces* in Climate Zones 1, 2, ~~and~~ 3, 4a and 4b, shall comply with one or more of the options in Table C402.2.1.1.

(Portions of text not shown remains unchanged)

Reason: Cool roofs are cost effective in climate zones 4a and 4b. Currently, the cool roof provision applies only to climate zones 1 through 3. This proposal expands the cool roof provision to climate zones 4a and 4b, where there is overwhelming evidence that cool roofs provide consistent and significant energy savings and energy cost savings.

Roofs that have a high solar reflectance and high thermal emittance (cool roofs) stay cooler in the sun. Cool roofs will have multiple benefits in climate zones 4a and 4b.

- Switching to cool roofs across climate zones 4a and 4b generates energy savings and energy cost savings.
- Cool roofs help reduce peak load in IECC climate zones 4a and 4b.
- The benefits of cool roofs have been proven beneficial in major metropolitan areas within climate zones 4a and 4b. Several major cities in climate zone 4 have adopted the use of cool roofs on commercial, low-sloped roofs into law.
- Cool roofs provide a cooler environment for roof equipment, thus enabling better performance for rooftop equipment.
- In many cases roof construction can have a cool roof option with zero price premium. Some cool roofs have small price premiums.
- Cool roofs have many important co-benefits. For example, a large number of cool roofs will reduce the summer air temperature in cities and therefore improve resiliency of urban populations to heat events.

The following technical analyses and substantiating information supports this proposal.

1) **Switching to cool roofs across IECC Climate Zones 4a and 4b generates energy savings and energy cost savings.**
   a. Cool roofs have a positive net energy savings in most parts of the country (Figure 1) and net energy cost savings in most parts of the country (Figure 2).[1]

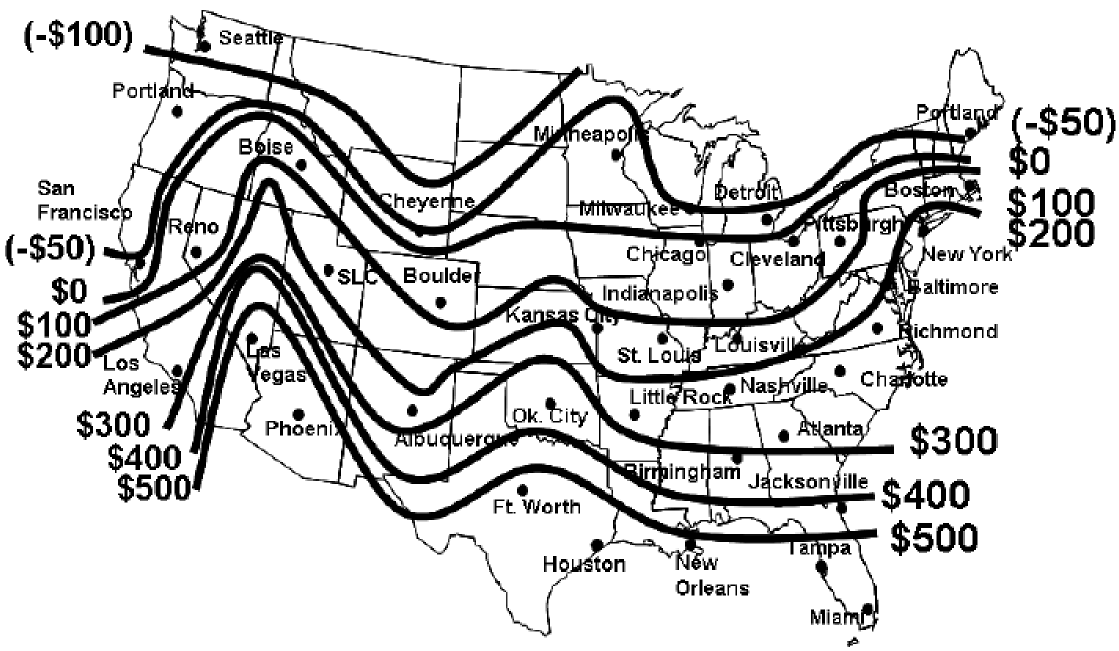
Figure 1: Cooling energy savings and heating energy penalty for commercial buildings with low-sloped roofs that have installed cool roofs. Calculations are based on increasing the aged solar reflectance of the roof to 0.55 from 0.20. Data from Levinson and Akbari (2010). Btu conversions added by GCCA. Annual net energy savings = annual cooling energy savings – heating energy penalty. *Values for other climate zones are available in the Levinson and Akbari (2010) paper.*

DOE benchmark city	State	Climate Zone	new office annual cooling-energy savings (Btu/m^2)	new office annual heating-energy penalty (Btu/m^2)	new office annual net energy savings (Btu/m^2)
Baltimore	MD	4A	7,034	4,766	2,268
Albuquerque	NM	4B	10,084	4,714	5,370

Figure 2: Net energy cost savings for commercial buildings with low-sloped roofs that have installed cool roofs. Calculations are based on increasing the aged solar reflectance of the roof to 0.55 from 0.20. Data from Levinson and Akbari (2010) with updated energy prices from EIA 2010.*Values for other climate zones are available upon request by e-mail.*

DOE benchmark cities	State	Climate Zone	new office annual energy-cost saving ($/ft^2)	new retail annual energy-cost saving ($/ft^2)
Baltimore	MD	4A	$ 0.01	$ 0.02
Albuquerque	NM	4B	$ 0.02	$ 0.03

   b. The breakeven line for cool roofs is well north of climate zones 4a and 4b.
   Figure 3: Net Annual Energy Cost Savings for a reflective roof versus a non-reflective roof (dollars per 20,000 square foot roof area) for low-sloped commercial buildings. Calculations were made using the DOE Cool Roof Calculator.[2]



2) **Cool roofs help reduce peak load in IECC Climate Zones 4a and 4b.**
   a. According to a recent study, peak energy savings from cool roofs are significant in all climate zones.[3]
   b. According to an analysis conducted for the Environmental Protection Agency[4], adopting cool roofs across 11 metropolitan areas generates peak energy savings for all of them. The three cities included in the study from climate zone 4a had peak annual energy savings from commercial buildings as follows:
   New York – 95 MW
   Philadelphia – 49 MW
   DC/Baltimore – 31 MW

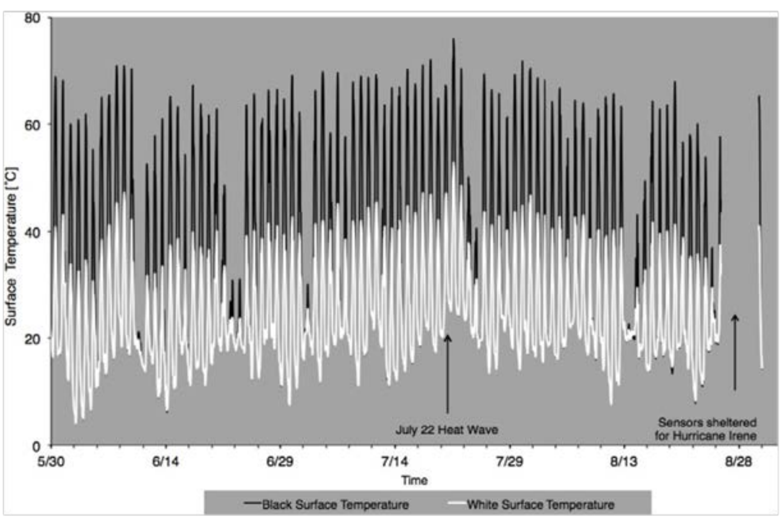
3) **The benefits of cool roofs have been proven beneficial in major metropolitan areas within climate zones 4a and 4b. Several major cities in climate zone 4 have adopted the use of cool roofs on commercial, low-sloped roofs into law.**
   a. A study that analyzed temperature data collected from three different roof surface treatments in Long Island City, Queens, New York found that the white roof surfaces did not show any "winter heating penalty" relative to the black roofs, and found that white roofs generate an energy cost savings of approximately $200 per year.[5]
   b. A study which analyzed the building energy impacts of the use of light colored roofs across the US found net energy cost savings for commercial buildings in all eleven of the metropolitan areas it analyzed.[6] GCCA updated this analysis using EIA electricity and natural gas data from 2010. See Figure 4, below.
   Figure 4: Annual energy savings and energy cost savings per 1,000 square feet of roof area of air conditioned commercial buildings resulting from the application of light colored roofs. Building energy data from Konopacki et al. Energy cost data from EIA 2010.

Metropolitan Area	Annual Savings on Commercial Buildings					
	Climate Zone	electricity (kWh)	gas (therms)	electricity savings ($)	heating energy penalty ($)	net energy savings ($)
Atlanta	3A	239	-6	21.65	-6.57	15.08
Chicago	5A	228	-15	20.25	-13.14	7.11
Los Angeles	3B	350	-3	45.85	-2.49	43.36
Dallas / Forth Worth	3A	224	-4	20.59	-3.16	17.43
Houston	2A	261	-2	23.99	-1.58	22.41
Miami/ Ft. Lauderdale	1A	340	0	33.18	0	33.18
New Orleans	2A	287	-2	24.4	-1.97	22.43
New York	4A	211	-9	34.41	-9.79	24.62
Philadelphia	4A	232	-14	23.43	-14.66	8.77
Phoenix	2B	409	-2	38.73	-2.14	36.59
DC/Baltimore	4A	221	-9	29.66	-11.03	18.63

c. New York, Philadelphia, and Washington DC all require cool roofs. All of these cities are in climate zone 4. In all cases, these ordinances were adopted in an effort to generate building energy savings and mitigate the urban heat island.
   - As of January 2012, New York City requires cool roofs on new and replacement low-sloped roofs (Local Laws of the City of New York for the Year 2011, #21). Roofs must have a minimum initial reflectance of 0.7 and initial thermal emittance of 0.75 or an SRI of 78.
   - Washington DC's Construction Code of 2008 for commercial buildings includes a provision on cool roofs in Chapter 15A. Low-sloped roofs are required to have a minimum initial SRI of 78 or comply with Energy Star. In December 2012, the Washington DC Department of Consumer and Regulatory Affairs and the Construction Codes Coordinating Board published a proposed rulemaking to adopt IECC 2012 section C402.2.1.1 with an amendment to include climate zone 4.
   - In April, 2010, the City of Philadelphia issued an ordinance (#090923) that all low-sloped roofs on new buildings and additions to existing buildings be Energy Star rated as highly reflective.

4) Cool roofs provide a cooler environment for roof equipment

a. Cool roofs lead to less thermal expansion due to their cooler temperatures.[7]
   Figure 5: White and black roof temperatures on a building in New York City through the summer of 2011.[7]



5) **In many cases roof construction can have a cool roof option with zero price premium. Some cool roofs have small price premiums.**

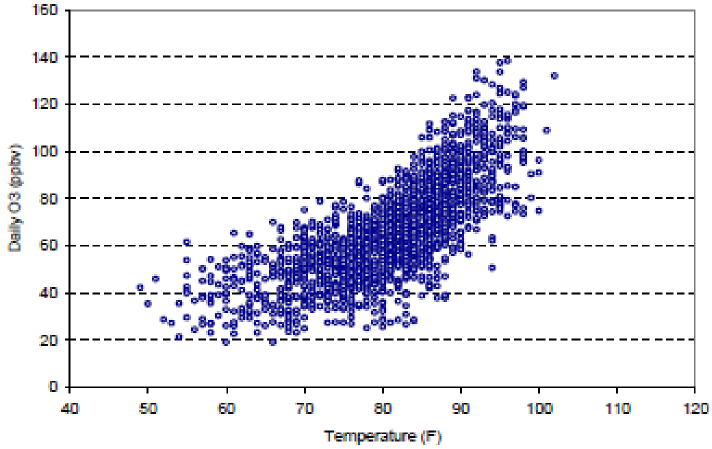
a. As with most construction materials, pricing can vary by market. According to EPA's Cool Roof website states, the cost premium for cool roofs versus conventional roofing materials ranges from zero to 5 or 10 cents per square foot for most products.[8]

6) Cool roofs provide co-benefits beyond building energy efficiency

a. Cool roofs help reduce ambient air temperatures, which in turn lower the incidences of smog formation.[9]

Figure 6 shows that as the surface temperature at Baltimore Washington International Airport (x-axis) rises, peak 8-hour ozone concentrations (y-axis) rise at an accelerated pace. Plots above horizontal red line indicate readings that exceeded the EPA compliance standard.

Figure 6: Maximum surface temperature at BWI versus peak 8-hour ozone concentrations



b. Cool roofs improve resiliency of urban populations to heat events.
A report for the Environmental Protection Agency studied the estimated mortality attributed to actual extreme heat events in Detroit, Philadelphia, Los Angeles, and New Orleans. Scenarios where the cities had higher albedos (10% improvements and 20% improvements) and greater vegetative cover suggest reductions in mortality during extreme heat events when cool surfaces are used to reduce urban temperatures. The paper models three multi-day heat events in Philadelphia (Climate Zone 4a) and estimated a reduction in mortality of approximately 5.5% as a result of a 10% improvement in urban reflectivity.[10]

References:

1) Ronnen Levinson and Hashem Akbari, "Potential benefits of cool roofs on commercial buildings," *Energy Efficiency* (2010) 3:53-109.
2) Hoff, J. L. (2005). The Economics of Cool Roofing: A local and regional approach. *Proceedings of Cool Roofing: Cutting through the Glare*, Atlanta, Georgia, May 2005.
3) Hoff, J. L. (2012) An outcome-based, multi-variate approach to roof surface thermal contribution. *Proceedings of the International Roof Coatings Conference*, Baltimore, MD, July 2012.
4) Konopacki et al., "Cooling Energy Savings Potential of Light-Colored Roofs for Residential and Commercial Buildings in 11 U.S. Metropolitan Areas", a report prepared for the Environmental Protection Agency, 1997.
5) Gaffin, S.R., Rosenzweig, C., Eichenbaum-Pikser, J., Khanbilvardi, R. and Susca, T., 2010. "A Temperature and Seasonal Energy Analysis of Green, White, and Black Roofs" Columbia University, Center for Climatic Systems Research. New York.
6) Konopacki et al., "Cooling Energy Savings Potential of Light-Colored Roofs for Residential and Commercial Buildings in 11 U.S. Metropolitan Areas", a report prepared for the Environmental Protection Agency, 1997.
7) Gaffin et al., "Bright is the New Black" Environmental Research Letters 7 (2012).
8) http://www.epa.gov/hiri/mitigation/coolroofs.htm
9) Russell Dickerson et al., "Climate Change and Air Quality for Baltimore and Washington," a contribution to ACCENT CCAQ: Group 1 (2007).
10) Kalkstein and Sheridan, "The Heat Impact of Heat Island Reduction Strategies on Health-Debilitating Oppressive Air Masses in Urban Areas" a report for the EPA, 2003.

Cost Impact: The code change proposal will not increase the cost of construction.

CE116-13

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

C402.2.1.1-EC-DICKIE.doc

CE117 – 13
C402.1, C402.1.1, Table C402.2.1.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Sections C402.1.1 and C402.3. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.

~~C402.2.1.1~~ C402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal, directly above cooled *conditioned spaces* in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table ~~C402.2.1.1~~ C402.3.

Exceptions: The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:

1. Portions of roofs that include or are covered by:

   1.1. Photovoltaic systems or components.
   1.2. Solar air or water heating systems or components.
   1.3. Roof gardens or landscaped roofs.
   1.4. Above-roof decks or walkways.
   1.5. Skylights.
   1.6. HVAC systems, components, and other opaque objects mounted above the roof.
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) ($74 kg/m^2$) or 23 psf ($117 kg/m^2$) pavers.
4. Roofs where a minimum of 75 percent of the roof area meets a minimum

TABLE ~~C402.2.1.1~~ C402.3
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

This section is currently located incorrectly under parent section C402.2, which addresses insulation. This section has nothing to do with insulation. Therefore, this proposal renumbers the section, relocating it in a manner that separates it from the insulation requirements. The table referenced in this section is also proposed to be renumbered to coordinate with the revised section number.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE117-13

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

CE118 – 13
C202 (NEW), C402.2.1.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.1.1 Roof solar reflectance and thermal emittance. Low sloped roofs~~, with a slope less than 2 units vertical in 12 units horizontal,~~ directly above cooled conditioned spaces in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table C402.2.1.1.

> **Exceptions:** The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:
>
> 1. Portions of roofs that include or are covered by:
>   - 1.1. Photovoltaic systems or components.
>   - 1.2. Solar air or water heating systems or components.
>   - 1.3. Roof gardens or landscaped roofs.
>   - 1.4. Above-roof decks or walkways.
>   - 1.5. Skylights.
>   - 1.6. HVAC systems, components, and other opaque objects mounted above the roof.
> 2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.
> 3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.
> 4. Roofs where a minimum of 75 percent of the roof area meets a minimum of one of the exceptions above.

Add new definition as follows:

<u>**LOW SLOPED ROOF.** A roof having a slope less than 2 units vertical in 12 units horizontal.</u>

Reason: This proposal simplifies criteria for low sloped roofs by adding a definition for the term "low slope roof." The current code text includes within it a definition that might be better placed in the definitions section of the code. Alternatively, if this is the only place the term is used, the need for a definition is moot if the text is then revised as "Roofs with a slope less than 2 units vertical in 12 units horizontal directly above…."

Cost Impact: The code change proposal will not increase the cost of construction.

CE118-13

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

C402.2.1.1-EC-WILLIAMS.doc

CE119 – 13

Table C402.2.1.1, Chapter 5

Proponent: Sherry Hao, Energy Solutions, representing Cool Roof Rating Council (sherry@coolroofs.org)

Revise as follows:

TABLE C402.2.1.1
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

b. Solar reflectance tested in accordance with ASTM C1549, ASTM E903, ~~or~~ ASTM E1918, or the CRRC-1 Standard.
c. Thermal emittance tested in accordance with ASTM C1371, ~~or~~ ASTM E408, or the CRRC-1 Standard.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612

CRRC-1-12 CRRC-1 Standard

Reason: The Cool Roof Rating Council is recommending that another choice be integrated into the IECC. In this case the CRRC-1 Standard.

The Cool Roof Rating Council was created in 1998 to develop accurate and credible methods for evaluating and labeling the solar reflectance and thermal emittance (radiative properties) of roofing products and to disseminate the information to all interested parties. The CRRC is incorporated as a non-profit educational organization for the following purposes:

- To implement and communicate fair, accurate, and credible radiative energy performance rating systems for roof surfaces.
- To support research into energy related radiative properties of roofing surfaces, including durability of those properties.
- To provide education and objective support to parties interested in understanding and comparing various roofing options.

The CRRC-1 Standard is a testing standard that has many features which are attractive to roof product manufacturers which are beyond the ASTM standards already cited in this these provisions. This document:

- Defines and covers both initial and aged testing requirements
- Covers variegated, granular coated, and custom colored roof products
- Specifies roof product specimen preparation
- Addresses how to handle specimens which may be uncharacteristically damaged during testing
- Specifies the minimum contents of a testing report

This is not a proprietary document, as it is material neutral. This document is not specifically tied to the Cool Roof Rating Council "Product Rating Program", but is designed to be independent of that program or any others.

This code change proposal does not attempt to remove the existing ASTM standards as industry in past code hearings has indicated that it wishes to retain those options currently available to them.

The standard is available at no charge at http://www.coolroofs.org for viewing or downloading.

Cost Impact: The code change proposal will not increase the cost of construction. None know.

Analysis: A review of the standard proposed for inclusion in the code, CRRC-1-2012 – CRRC-1 Standard, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE119-13

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

C402.2.1.1T-EC-HAO

CE120 – 13
Table C402.2.1.1, Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C402.2.1.1 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Three –year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
~~Initial solar reflectance[b] of 0.70 and initial thermal emmittance[c] of 0.75~~
~~Three-year aged s~~Solar reflectance index[d] of 64
~~Initial solar reflectance[d] of 82~~

a. [delete foot note a and renumber subsequent footnotes as a, b and c]
b. Solar reflectance tested in accordance with ~~ASTM C 1549, ASTM E 903 or ASTM E 1918~~ CRRC-1 Standard.
c. Thermal emittance tested in accordance with ~~ASTM C 1371 or ASTM E 408~~ CRRC-1 Standard.
d. Solar reflectance index (SRI) ~~shall be~~ determined in accordance with ASTM C 1980 using a convection coefficient of 2.1 Btu/h x ft^2 x F~~. Calculation of aged SRI shall be based on aged testing values of solar reflectance and emittance. Calculation of initial SRI shall be~~ based on ~~initial tested values of solar reflectance and thermal emittance~~ three-year aged solar reflectance and three-year aged thermal emittance testing in accordance with CRRC-1 Standard.

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612

CRRC-1-12 CRRC-1 Standard

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised with respect to certain HVAC equipment efficiency criteria. The change ensures continued consistency between the IECC and standard 90.1-2010.

ASHRAE SSPC 90.1 also chose to adopt the CRRC-1 Standard as the document for testing roofing products. This testing standard has many features which are attractive to roof product manufacturers which are beyond the ASTM standards already cited in this these provisions. This document:

- Defines and covers both initial and aged testing requirements
- Covers variegated, granular coated, and custom colored roof products
- Specifies roof product specimen preparation
- Addresses how to handle specimens which may be uncharacteristically damaged during testing
- Specifies the minimum contents of a testing report

This is not a proprietary document, as it is material neutral. This document is not specifically tied to the Cool Roof Rating Council "Product Rating Program", but is designed to be independent of that program or any others. The standard is available at no charge at http://www.coolroofs.org for viewing or downloading.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, CRRC-1-2012 – CRRC-1 Standard, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE120-13

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

C402.2.1.1T-EC-FERGUSON.doc

CE121 – 13
Table C402.2.1.1, C402.1.1.1 (NEW), Chapter 5

Proponent: Robert A. Zabcik, P.E., NCI Building Systems, Inc., representing Cool Metal Roofing Coaliton

Revise as follows:

TABLE C402.2.1.1
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
~~Initial solar reflectance[b] of 0.70 and initial thermal emittance[c] of 0.75~~
Three-year-aged solar reflectance index[d] of 64
~~Initial solar reflectance index[d] of 82~~

a. The use of area-weighted averages to meet these requirements shall be permitted. ~~Materials lacking initial tested values for either solar reflectance or thermal emittance, shall be assigned both an initial solar reflectance of 0.10 and an initial thermal emittance of 0.90.~~ Materials lacking three-year aged tested values for either solar reflectance or thermal emittance shall be assigned ~~both~~ a three-year aged solar reflectance <u>in accordance with Section C402.2.1.1.1</u> ~~of 0.10~~ and a three-year aged thermal emittance of 0.90.

b. <u>Aged s</u>~~S~~olar reflectance tested in accordance with <u>CRRC-1</u>~~ASTM C 1549, ASTM E 903or ASTM E 1918~~.

c. <u>Aged t</u>~~T~~hermal emittance tested in accordance with <u>CRRC-1</u>~~ASTM C 1371 or ASTM E408~~.

d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E 1980 using a convection coefficient of 2.1 Btu/h × ft2 ×°F (12W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. ~~Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.~~

<u>**C402.2.1.1.1 Aged roof solar reflectance.** Where an aged solar reflectance required by Section C402.2.1.1 is not available, it shall be determined in accordance with Equation 4-X.</u>

<u>$R_{aged} = [0.2+0.7(R_{initial}-0.2)]$ (Equation 4-X)</u>

<u>where:</u>

<u>R_{aged} = The aged solar reflectance</u>

<u>$R_{initial}$ = The initial solar reflectance determined in accordance with CRRC-1</u>

Add new standard to Chapter 5 as follows:

<u>**CRRC** Cool Roof Rating Council</u>
<u>1610 Harrison St</u>
<u>Oakland, CA 94612</u>

<u>CRRC-1 2012 Cool Roof Rating Council, CRRC-1 Standard</u>

Reason: The use of initial values for compliance with solar reflectance (SR) and thermal emittance (TE) requirements as opposed to three-year aged values is not representative of real-word conditions. Weathering of most roofing materials greatly changes the SR and to a lesser degree, the TE, as documented by Lawrence Berkeley and Oak Ridge National Laboratories. The California Energy Commission (CEC) Title 24 Building Energy Efficiency Standards has addressed this issue very effectively since 2005. By requiring 3-year aged SR and TE values, a more realistic SRI is obtained; one that represents the performance of the roofing material during the life of the material rather than at the time of installation. The Cool Roof Rating Council (CRRC) has simultaneously developed the CRRC-1 standard to rigorously qualify the test procedures used to measure SR and TE, as well as the aging process. Thus, referencing the CRRC-1 standard is much more thorough than simply referencing the ASTM test methods used to measure SR and TE directly. The CRRC has recently been ANSI accredited to develop standards, further adding credibility.

The CRRC-1 standard uses the same test methods as the 2012 IECC, with the exception of ASTM E 408, which measures direct normal TE using a handheld device. (ASTM C 1371 measures the TE averaged over a hemisphere and the two methods can yield greatly different results.) Energy Star has recently dropped ASTM E408 as well. Furthermore, the test procedures are further qualified to ensure consistency across all tested roofing products, including variegated products such as granule coated shingles. The aging process has absolutely no qualification as currently specified in the IECC. The CRRC-1 Standard very effectively addresses this gap as well by specifying multiple test farms sites and accrediting labs to age and test specimens for SR and TE. It also outlines a color family program that allows manufacturers of colored products to group and test their products in representative lots. The downside is that the aging process takes three years. However, the CEC has included the aging formula presented in proposed new Section C402.2.1.1.1 since 2005 to predict aged values, which is also introduced in this proposal to provide values to use before testing is completed. This formula is based on a curve fit of the CRRC dataset and provides aged values of SR with conservatism and accuracy.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, CRRC-1-2012 – CRRC-1 Standard, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE121-13

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

C402.2.1.1T-EC-ZABEIK.doc

CE122 – 13
C402.2.1.1, C402.2.1.1.1 (NEW), C402.2.1.2 (NEW), Chapter 5

Proponent: Amy Dickie, Global Cool Cities Alliance (amy@globalcoolcities.org), Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Delete and substitute as follows:

~~**C402.2.1.1 Roof solar reflectance and thermal emittance.** Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal, directly above cooled *conditioned spaces* in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table C402.2.1.1.~~

> ~~**Exceptions:** The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:~~
>
> ~~1. Portions of roofs that include or are covered by:~~
>   ~~1.1. Photovoltaic systems or components.~~
>   ~~1.2. Solar air or water heating systems or components.~~
>   ~~1.3. Roof gardens or landscaped roofs.~~
>   ~~1.4. Above-roof decks or walkways.~~
>   ~~1.5. Skylights.~~
>   ~~1.6. HVAC systems, components, and other opaque objects mounted above the roof.~~
> ~~2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.~~
> ~~3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) (74 kg/m2) or 23 psf (117 kg/m2) pavers.~~
> ~~4. Roofs where a minimum of 75 percent of the roof area meets a minimum of one of the exceptions above.~~

C402.2.1.1 Roof solar reflectance and thermal emittance. In climate zones 1, 2 and 3, roofs with a slope less than or equal to 2 units vertical in 12 units horizontal that are located directly above cooled conditions spaces shall have an average aged solar reflectance of not less than 0.55 and an average aged thermal emittance of not less than 0.75.

> **Exceptions:** The following roofs and portions of roofs are exempt from the requirements in this Section:
>
> 1. Portions of the roof that include or are covered by the following:
>   1.1. Photovoltaic systems or components
>   1.2. Solar air or water heating systems or components
>   1.3. Roof gardens or landscaped roofs
>   1.4. Above-roof decks or walkways
>   1.5. Skylights
>   1.6. HVAC systems, components, and other opaque objects mounted above the roof.
> 2. Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.
> 3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (lb/ft^2) [74 kg/m^2] or 23 psf (lb/ft^2) [117 kg/m^2] pavers.
> 4. Roofs where a minimum of 75 percent of the roof area meets one or more of the exceptions above.

C402.2.1.1.1 Alternative Compliance Pathways. Roofs or portions of roofs that comply with one or more of the following also shall be in compliance with C402.2.1.1.

1. An aged solar reflectance index of not less than 64.

2. An initial solar reflectance of not less than 0.70 and an initial thermal emittance of not less than 0.75.
3. An initial solar reflectance index of not less than 82.

C402.2.1.2 Roof testing. Roof product solar reflectance and thermal emittance shall be determined as follows:

1. The initial and aged solar reflectances and initial and aged thermal emittances of the roofing product shall be measured in accordance with the ANSI/CRRC-1 Standard.
2. Initial and aged values of solar reflectance index (SRI) shall be determined in accordance with ASTM E 1980 using a medium wind speed convective coefficient of 2.1 BTU/(h · ft^2 · °F) [12 W/(m^2 · K)]. Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.
3. Materials lacking initial tested values for either solar reflectance or thermal emittance shall be assigned both an initial solar reflectance of 0.10 and an initial thermal emittance of 0.90. Materials lacking aged tested values for either solar reflectance or thermal emittance shall be assigned both an aged solar reflectance of 0.10 and an aged thermal emittance of 0.90.

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612

CRRC-1-12 – CRRC-1 Standard

Reason: The 2012 IECC is the first I-code to contain substantive language for 'cool roofs'. This proposal makes technical corrections, reformats, and adds clarity to the language in Section C402.2.1.1, and adds a reference to the CRRC standard. Descriptions of specific changes and the reasons for each are described below.

1) Problem: The definition for low-sloped roofs is inconsistent with other major codes and standards, including ASHRAE and California's Title 24.
Solution: Change the definition of low-sloped roofs from a rise to run ratio of less than 2:12 to a rise to run ratio of less than or equal to 2:12. This change makes the definition of low-sloped roofs consistent with other codes (e.g. ASHRAE 90.1 and California's Title 24).
2) Problem: The code does not make clear which performance metric is preferred.
Solution: Reformat the code to state primary rating option (aged solar reflectance and aged thermal emittance) in the body of the code and the other rating options as exceptions. Note that although this change alters the format of the code, it has no influence on the stringency of the code.
3) Problem: The "three-year" specification is redundant to "aged". Further, future versions of the CRRC-1 Standard may allow a different time period for aged testing.
Solution: Remove the specification of "three-year" from the notation of aged reflectivity and aged emissivity values because the duration of the aging is explicit in the CRRC Standard, and should be changed as the standard evolves.
4) Problem: Important definitions and requirements for roof testing are included in footnotes and are therefore confusing and difficult to follow.
Solution: Move the footnotes that pertain to the testing requirements into a new section (Section C402.2.1.3), titled "Roof Testing". This change moves important definitions and requirements out of the footnotes, thus providing a cleaner format for the code.
5) Problem: The ANSI approval for the CRRC-1 Standard as a consensus standard had not been received at the time of the final action hearing of the last code cycle. Therefore, the code does not reference the most appropriate industry standard for roof testing and aging.
Solution: The CRRC-1 Standard is now an ANSI approved consensus standard. This code change references what most stakeholders consider to be the most appropriate standard, which now complies with ICC CP-28.

Cost Impact: The codec change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, CRRC-1-2012 – CRRC-1 Standard, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE122-13
Public Hearing: Committee: AS AM D

Assembly: ASF AMF DF

C402.2.1.1(NEW)-EC-CONNER-DICKIE.doc

CE123 – 13
C202, C402.2.2, C402.2.2.1, C402.2.2

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Delete without substitution as follows:

SECTION C202
GENERAL DEFINITIONS

~~**C402.2.2 Classification of walls.** Walls associated with the building envelope shall be classified in accordance with Section C402.2.2.1 or C402.2.2.2.~~

~~**C402.2.2.1 Above-grade walls.** Above-grade walls are those walls covered by Section C402.2.3 on the exterior of the building and completely above grade or walls that are more than 15 percent above grade.~~

~~**C402.2.2.2 Below-grade walls.** Below-grade walls covered by Section C402.2.4 are basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.~~

Revise definitions as follows:

~~**BASEMENT WALL.** A wall 50 percent or more below grade and enclosing *conditioned space.*~~

<u>**ABOVE-GRADE WALL**. The walls on the exterior of the building and completely above grade or walls that are more than 15 percent above grade.</u>

<u>**BELOW-GRADE WALL.** The basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.</u>

Reason: The purpose of this code change is to clarify the code. First, this proposal moves definitions of “above-grade walls” and “below-grade walls” from chapter four to chapter two, where general definitions, such as these, more appropriately belong. The proposal also eliminates the definition of “basement wall” as unnecessary, inconsistent, and potentially confusing in the commercial energy code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE123-13

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

C402.2.2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE124 – 13
C202 (New), C402.2.2, C402.2.2.1, C402.2.2.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Delete without substitution as follows:

~~**C402.2.2 Classification of walls.** Walls associated with the building envelope shall be classified in accordance with Section C402.2.2.1 or C402.2.2.2.~~

~~**C402.2.2.1 Above-grade walls.** Above-grade walls are those walls covered by Section C402.2.3 on the exterior~~
~~of the building and completely above grade or walls that are more than 15 percent above grade.~~

~~**C402.2.2.2 Below-grade walls.** Below-grade walls covered by Section C402.2.4 are basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.~~

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building.

WALL, BELOW-GRADE. A wall associated with the basement or first story of the building that is part of the *building thermal envelope* , is at least 85 percent below grade and is on the exterior of the building.

Reason: In order to clarify and simplify the code, this proposal replaces the current text indicating how to determine a wall classification with a formal definition of each wall type

Section C402.2.2 contains only definitions that are more appropriately located in Section C202. Application of the current Sections C402.2.3 (above grade walls) and C402.2.4 (below grade walls) are clear as to requirements and can be readily and more easily applied by locating the definitions of those terms in the definitions section as opposed to another section of the code.

The current code provisions are technically incorrect. They refer to the building envelope (not the defined term building thermal envelope) and the exterior of the building. This omits any wall that is an interior wall that is part of the building thermal envelope, which is where the heat transfer occurs that the code is intending to address. Examples of this are a stairway wall separating an unconditioned basement from a conditioned first floor or a wall separating a conditioned basement from a vented crawl space. A strict application of the current code would eliminate such walls from having to be insulated because they are neither on the building exterior nor associated with the building envelope. The proposed definitions, therefore, cover all possible walls that could be part of the building thermal envelope (those bounded completely or partially by earth, those exposed to the outdoor elements and not bounded by earth, and those separating conditioned from unconditioned or exempt spaces regardless of location in relation to grade) in a clearer manner.

Cost Impact: The code change proposal will not increase the cost of construction.

CE124-13

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

C402.2.2-EC-WILLIAMS.doc

CE125 – 13
Table C402.2, C402.2.2, C402.2.2.1, C402.2.2.2, C402.2.3, C402.2.4

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

~~**C402.2.2 Classification of walls.** Walls associated with the building envelope shall be classified in accordance with Section C402.2.2.1 or C402.2.2.2.~~

~~**C402.2.2.1 Above-grade walls.** Above-grade walls are those walls covered by Section C402.2.3 on the exterior of the building and completely above grade or walls that are more than 15 percent above grade.~~

~~**C402.2.2.2 Below-grade walls.** Below-grade walls covered by Section C402.2.4 are basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.~~

C402.2.3 Thermal resistance of ~~above-grade~~ walls <u>more than 15 percent above grade</u>. <u>For exterior walls that are completely above grade or are more than 15 percent above grade,</u> the minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.

"Mass walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m^2) of wall surface area; or
2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).

C402.2.4 Thermal resistance of ~~below-grade~~ walls at <u>least 85 percent below grade</u>. <u>For exterior walls that are at least 85 percent below grade,</u> the minimum thermal resistance (*R*-value) of the insulating material installed in, or continuously on, the ~~below-grade~~ walls shall be as specified in Table C402.2, and shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the floor, whichever is less.

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation Entirely Above Roof Deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal Buildings (with R-5 thermal blocks)[a,b]	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-25 + R11 LS	R-25 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS
Attic and other[a]	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R–49	R-49	R-49	R-49	R-49	R-49	R-49
Exterior Walls~~,~~ completely or more than 15 Percent Above Grade																
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-19.5ci
Metal Framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other[f]	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 +3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-15.6ci or R20 + 10ci	R-13 + R-15.6ci or R20 + 10ci
Exterior Walls~~,~~ At Least 85 Percent Below Grade																
~~Wall~~ Walls at least 85 percent Below Grade [d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R- 12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist / Framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab on Grade Floors																
Unheated Slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" in. below	R-10 for 24" in. below	R-10 for 24" in. below	R-10 for 24" in. below	R-10 for 24" in. below	R-15 for 24" in. below	R-15 for 24" in. below	R-15 for 24" in. below	R-15 for 24" in. below	R-20 for 24" in. below
Heated Slabs[d]	R-7.5 for 12" in. below	R-7.5 for 12" in. below	R-7.5 for 12" in. below	R-7.5 for 12" in. below	R-10 for 24" in. below	R-10 for 24" in. below	R-15 for 24" in. below	R-15 for 24" in. below	R-15 for 36" in. below	R-15 for 36" in. below	R-15 for 36" in. below	R-20 for 48" in. below	R-20 for 24" in below	R-20 for 48" in below	R-20 for 48" in below	R-20 for 48" in below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.
LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ASHRAE 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method in Table C402.1.2.
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. Steel floor joist systems shall ~~to~~ be insulated to R-38.

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

This proposal moves and clarifies, but does not delete the requirements of existing Sections C402.2.2, C402.2.2.1 and C402.2.2.2 of the 2012 IECC.

The code currently has definitions in Chapter 2 for “above-grade” and “basement walls” which conflict with Sections C402.2.1 and C402.2.1, which are also essentially definitions. Furthermore, as Sections 402.2.1 and C402.2.2.2 are not referenced in C402.2.3 and C402.2.4, it is not immediately clear which definitions apply to Sections C402.2.3 and C402.2.4. To eliminate this confusion and add clarity, we propose that the technically important content from Sections C402.2.2.1 and C402.2.2.2 (i.e., percentages above or below grade) be moved into Sections C402.2.3 and C402.2.4, respectively, and that the terms “above grade” and “basement” or “below grade” walls be eliminated. In this manner, confusion is eliminated with other code sections that rely on the Chapter 2 definitions.

Note that the SEHPCAC also submitted a separate proposal to delete Section C402.2.4. This proposal works whether or not that proposal is successful. The committee’s preference is that both proposals be approved, resulting in the deletion of Section C402.2.4 and the approval of all other provisions in this proposal.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code’s prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE125-13

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

C402.2.2-EC-THOMPSON-SEHPCAC

CE126 – 13
C402.2.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.3 Thermal resistance of above-grade walls. The minimum thermal resistance (R-value) of the insulating materials installed in the wall cavity between the framing members, where required, and continuously on the walls, where required, shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The R-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table 402.2.

"Mass walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m2) of wall surface area; or
2. 25 psf (120 kg/m2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m3).

Reason: This proposal clarifies the provisions in the code related to above-grade walls. The current code indicates that the insulation is to be applied between framing members and continuously on the wall. This is never the case for mass walls where only continuous insulation is to be applied and for wood framed walls in some climate zones continuous insulation may not be required to be applied, depending on the insulation option chosen in Table C402.2. Adding the words "where required" allows for cases where either but not both are required or where both are required.

Cost Impact: The code change proposal will not increase the cost of construction.

CE126-13

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

C402.2.3-EC-WILLIAMS.doc

CE127 – 13
C402.2.3, R402.2.5 (IRC N1102.2.5)

Proponent: James D. Katsaros, PhD, DuPont Building Innovations (james.d.katsaros@dupont.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.2.3 Thermal resistance of above-grade walls. The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.

"Mass Walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m^2) of wall surface areas; ~~or~~
2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pound per cubic foot (pcf) (1900 kg/m^3), or
3. Having a heat capacity greater than or equal to 6 BTU/ft^2 x ^{o}F [123 kJ/m^2 x K].

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R402.2.5 (N1102.2.5) Mass Walls. Mass walls for the purpose of this chapter shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs, or any other walls having a heat capacity greater than or equal to 6 BTU/ft^2 x ^{o}F) [123 kJ/m^2 x K].

Reason: This proposal adds a heat capacity provision to mass wall definition to be consistent with IRC definition

Cost Impact: This code change proposal will not increase the cost of construction.

CE127-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C402.2.3-EC-KATSARAS.doc

CE128 – 13
C402.2.4

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.4 Thermal resistance of below-grade walls. The minimum thermal resistance (R-value) of the insulating materials installed ~~in, or~~ continuously <u>within or </u>on the below-grade walls shall be as specified in Table C402.2 and shall extend to a depth of <u>not less than </u>10 feet (3048 mm) below the outside finish ground level, or to the level of the floor<u> of the conditioned space enclosed by the below-grade wall</u>, whichever is less.

Reason: This proposal clarifies where and how insulation is to be installed on below-grade walls. The term "installed in or continuously on" is potentially confusing in that it infers that the insulation could be inside the wall but not necessarily continuous. The proposal also clarifies where the 'depth of burial' measurements are to be made.

Where insulation is required, the current code requires it to be continuous insulation. The term "installed in, or" is potentially confusing in that it infers that the insulation could be inside the wall but not necessarily continuous. The proposed change ensures that regardless of the location of the insulation, the insulation that is applied must be continuous as provided in Table C402.2. As a minimum code, it is more appropriate to state measurements such as depth of burial as minimums that can be exceeded rather than a single "one length only" criterion. The term "floor" can be clarified further to indicate what floor is being considered. For instance, a wall separating an unconditioned crawl space from a conditioned basement or below-grade room could be a below-grade wall bounded by two floors (one in the conditioned space and the grade in the crawl space). The proposed text ensures there is no confusion as to what floor the insulation depth is to be measured.

Cost Impact: The code change proposal will not increase the cost of construction.

CE128-13

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

C402.2.4-EC-WILLIAMS.doc

CE129 – 13
C402.2.5

Proponent: Joseph Lstiburek, Building Science Corporation, representing self

Delete and substitute as follows:

~~**C402.2.5 Floors over outdoor air or unconditioned space.** The minimum thermal resistance (*R*-value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Table C402.2, based on construction materials used in the floor assembly.~~

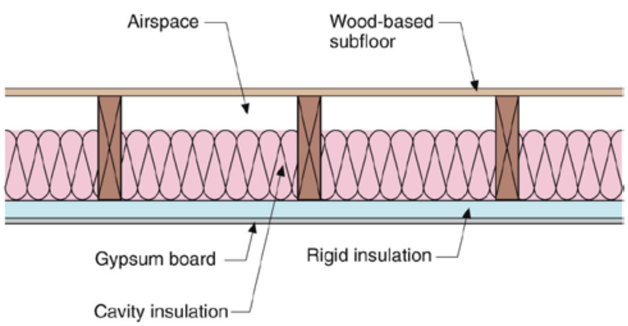
~~"Mass floors" shall include floors weighing not less than:~~

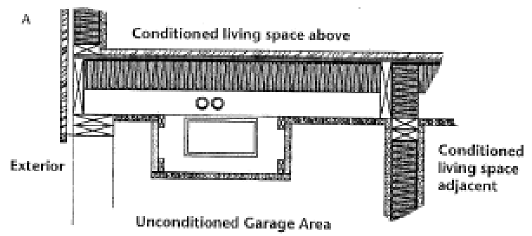
1. ~~35 psf (170 kg/m^2) of floor surface area; or~~
2. ~~25 psf (120 kg/m^2) of floor surface area if the material weight is not more than 12 pcf (1,900 kg/m^3).~~

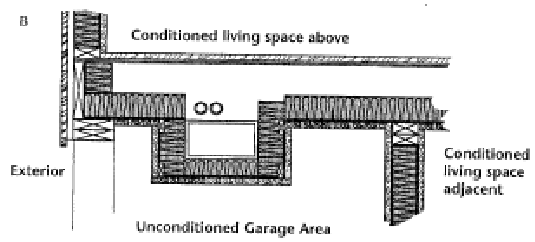
<u>**C402.2.5 Floors.** Floor framing cavity insulation or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.</u>

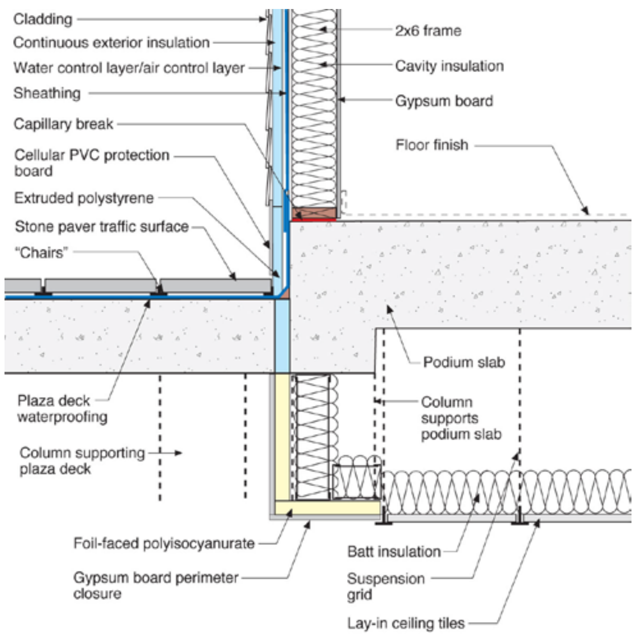
> <u>**Exception:** The floor framing cavity insulation or structural slab insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing when combined with insulation that meets or exceeds the minimum Metal framed or Wood framed and other Walls, Above Grade, R-value in Table C402.1.2 and extends from the bottom to the top of all perimeter floor framing or floor assembly members</u>.

Reason: Requiring insulation in floors to be in direct contact with the underside of subfloor decking or structural slabs is one insulating option. Another option is to have an airspace between the floor sheathing and structural slabs and the top of the cavity insulation where this cavity insulation is in direct contact with the topside of sheathing or continuous insulation installed on the underside of the floor framing and is combined with perimeter insulation that meets or exceeds the R-value requirements for walls. This second option leads to fewer cold spots yet does not change the heat loss as long as the cavity insulation is in direct contact with a sheathing below it or continuous insulation below it. It also facilitates services to be enclosed within the thermal envelope. Examples of these configurations are illustrated below:









Cost Impact: This code change proposal will not increase the cost of construction. This proposal will not raise the cost of construction.

CE129-13

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

C402.2.5-EC-LSTIBUREK.doc

CE130 – 13
C402.2.5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.5 Floors ~~over outdoor air or unconditioned space~~. The minimum thermal resistance (R-value) of the insulating materials installed either between the floor framing or continuously on the floor assembly shall be as specified in Table C402.2, based on construction materials used in the floor assembly. Insulation applied on the underside of the floor assembly facing outdoor air or unconditioned space shall be installed to maintain permanent contact with the underside of the floor assembly.

> **Exception**: Insulation applied to the underside of concrete floor slabs shall be permitted an air space of not more than 1 inch where it turns up and is in contact with the underside of the floor under walls associated with the *building thermal envelope.*

Reason: There is no need to indicate in the title anything other than floors because the overall focus of Section 402 is the building thermal envelope, which as defined eliminates the need to further specify any particular conditions associated with the floor. In addition Table C402.2 to which this section refers for insulation provisions refers simply to "floors". The provisions in R402.2.5 are equally applicable to floor assemblies in commercial buildings where insulation batts for instance may be installed in a floor framing assembly. The need to eliminate a space between the insulation and the underside of the floor is equally applicable in commercial buildings, many of which use the same construction practices as residential buildings. The situation where concrete floor decks may need an air space to address moisture control is covered through an exception that is intended to permit such space but also ensure the insulation is in contact with the floor deck under walls associated with the building thermal envelope so as to cut off any "short circuit" around the floor insulation at the perimeter of the floor deck. This proposal ensures that insulation applied in floors over outside air or unconditioned spaces is in contact with the underside of the floor deck above.

Cost Impact: The code change proposal will not increase the cost of construction.

CE130-13

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

C402.2.5-EC-WILLIAMS.doc

CE131 – 13
C402.2.6

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.2.6 Slab~~s~~-on-grade perimeter insulation. Where the slab-on-grade is in contact with the ground**,** the minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.2 shall be as specified in Table C402.2. The insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

> **Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

Reason: This public comment is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 2 open meetings and over 15 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The title of this section is proposed to be revised to clarify that:

a) Section C402.2.6 applies only to the perimeter insulation associated with slab-on-grade construction. This section does not apply to the insulation installed within or immediately above or below and in contact with the slab-on-grade construction.
b) Section C402.2.6 applies only to the R-value method in Section C402.1.1. It does not apply to the U-, C- and F-factor method in Section C402.1.2. (Note the ASHRAE 90.1 prescriptive tables referenced by Table C402.1.2 contain their own perimeter insulation requirements and are not reliant on Table C402.2.)

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE131-13

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

C402.2.6-EC-THOMPSON-SEHPCAC

CE132 – 13
C402.2.7, C402.3

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

Revise as follows:

C402.2.7 Opaque doors. Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors as specified in Table C402.2 and be considered as part of the gross area of above-grade walls that are part of the building envelope.

> **Exception:** Non-swinging doors intended for vehicular access and material transportation, with a minimum opening rate of 32 inches per second, shall have a U-factor not greater than 1.2.

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

> **Exception:** Non-swinging doors intended for vehicular access and material transportation, with a minimum opening rate of 32 inches per second, shall have a U-factor not greater than 1.2.

Reason: The Exceptions refer to door products known as "high speed doors". They are typically automatically controlled, non-swinging doors, and are commonly used in conjunction with vehicular traffic or transportation of materials and are not generally intended for pedestrian traffic. Sizes typically range from 8x8 to 12x12. When high speed doors are used in a building exterior envelope, the primary purposes are for environmental control and/or building security.

High speed door panels or curtains are usually made of a thin layer of vinyl, fabric, rubber or composite material. Materials can be opaque, translucent or a combination thereof.

The assemblies are constructed of flexible materials at the perimeter to provide sealing against air leakage but yet to allow variations in contact between door panels/curtains and jamb construction to maximize the effectiveness of continual high speed operation. Thus, high speed doors cannot comply with prescriptive U-factor requirements. The high speed nature of these doors provides for minimizing of "air exchange", a valuable and predominant characteristic of minimizing overall energy losses through a door opening.

A maximum U-factor value of 1.2 was validated by a 1.17 value obtained via a March 2012 DASMA-sponsored test on a representative 8'x8' high speed door product.

Cost Impact: The code change proposal will not increase the cost of construction.

CE132-13

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

C402.2.7-EC-HETZEL.doc

CE133 – 13
C202 (NEW), C402.2.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

~~C402.2.7~~ C402.3.5 ~~Opaque d~~Doors. *Opaque doors* ~~(having less than 50% glass area)~~ shall meet the applicable requirements for doors as specified in Table C402.2 and be considered part of the gross area of above-grade walls that are part of the building *thermal* envelope. All other doors shall meet the provisions of Section C402.3.3 for vertical fenestration.

Add a definition as follows:

OPAQUE DOORS. Doors that are at least 50 percent opaque in surface area.

Reason: As currently defined, doors are considered fenestration regardless of the percentage of glazing they contain. As such, users of the code would logically begin to look for and address the requirements for doors in the fenestration section of the code. Instead the provisions for opaque doors (those with less than 50% glass area) are located in Section C402.2.7 covering opaque assemblies. One could conclude from a review of this provision in the opaque section of the code that any door with at least 50-percent glass area must be fenestration. This proposal **clarifies** when doors are considered part of the opaque wall and subject to thermal requirements for the wall, and when doors are fenestration and subject to those requirements.

Relocation of the door provisions to the fenestration section of the code is appropriate, and from there doors that are opaque can be correctly referred back to the sections of the code addressing opaque assemblies and components. Note also the term glass area technically precludes consideration of other non-opaque materials. The proposed code change addresses this by using opaque area as the metric.

Cost Impact: The code change proposal does not increase the cost of construction.

CE133-13

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

C402.2.7-EC-WILLIAMS.doc

CE134 – 13
C202 (NEW), C402.2.8

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.8 Insulation of radiant heating systems. *Radiant* <u>*heating system*</u> panels~~,~~ and <u>their</u> associated <u>components</u> ~~U-bends and headers, designed for sensible heating of an indoor space through heat transfer from the thermally effective panel surfaces to the occupants or indoor space or thermal radiation and natural convection and the bottom surfaces of floor structures incorporating radiant heating~~ <u>that are installed in interior or exterior assemblies</u> shall be insulated with a minimum of R-3.5 (0.62 m2/K × W) <u>on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the R-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.2</u>.

<u>**Exception:** Heated slabs on grade insulated in accordance with Section C402.2.6.</u>

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**RADIANT HEATING SYSTEM.** A heating system that transfers heat to objects and surfaces within a conditioned space primarily by infrared radiation.</u>

Reason: This proposal clarifies that panels installed in building thermal envelope assemblies must be insulated in accordance with the requirements of the assembly in which they are installed. It also requires insulation of R-3.5 on the non-radiant surface when installed in interior assemblies and refer to the other applicable sections of the code for heated slab insulation. The objective of this proposal is to clarify language as radiant systems can be embedded in floor slabs or can be separate panels applied within wall or roof/ceiling assemblies.

In training sessions on the IECC conducted by the DOE Building Energy Codes Program it regularly comes up that the current provision in Section C402.2.8 conflicts with an R-5 requirement in the International Mechanical Code and the insulation requirements in the IECC for heated slabs. As heated slabs are different than radiant heating system panels and are already addressed in Section C402.2.8 the new exception is intended to address any confusion. Beyond heated slabs on grade, what remains are such systems and panels located within the building thermal envelope or within assemblies that are associated with the building interior but not the building thermal envelope. The proposed change clarifies that Section C402.2.7 applies to those conditions. It also clears up an interpretation issue. On the one hand, the current language can be interpreted to allow only R-3.5 on the back of a radiant panel installed within an exterior wall. On the other hand, the section could be interpreted to mean the radiant panel requires a minimum of R-3.5 no matter where installed, but does not relieve the requirement to provide the required insulation in an opaque wall assembly pursuant to the applicable provisions in Section C402.2. The proposed language makes it clear that the full insulation is required in the opaque wall where associated with the building thermal envelope. The intent of the building thermal envelope provisions is to minimize the heating loads on the building. It is not appropriate to reduce the required amount of insulation in an envelope assembly at the very location of such a heating system where a higher temperature difference occurs. In interior assemblies, the effectiveness of the radiant heating system is improved if heat loss to interior plenums or wall cavities is reduced. If the radiant system/panels cannot be located on an interior assembly and the satisfaction of the insulation level in an assembly associated with the building thermal envelope is challenging, then the option remains to use Section C402.1.2. The lengthy definitions of radiant heat embedded in the section are removed and a definition consistent with that in ANSI/ASHRAE/IES Standard 90.1-2010 for radiant heating systems is added to the IECC definitions.

If the current section is interpreted to require minimum insulation on radiant panels but not reduce any requirement for exterior wall insulation there will be no cost impact. Based on the interpretation that only R-3.5 is required for a radiant panel in an exterior wall, there may be a cost impact if the designer chooses to install such systems in building thermal envelope assemblies as opposed to other available interior assemblies. Additional cost could be incurred if providing the required insulation in a wall assembly where above the level of the currently required R-3.5. Where heaters are installed in exterior ceilings under an attic, there is very minimal additional cost to maintain the full attic insulation depth over the radiant panel. In actual practice, exterior wall installation is rare, as radiant heaters on the perimeter are typically installed inside the interior wall finish material. When installed in building thermal envelope assemblies, there is no reason why insulation equal to the same level as the remainder of the envelope assembly should not be required as the required level of insulation has been previously shown to be cost effective. Insulation adjacent to radiant panels will have a shorter payback due to the high temperature of the radiant panel compared to the space temperature that in turn increases the heat loss through the insulation.

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

Note: The term 'radiant heating system' is not defined in other International Codes. However the term 'radiant heater' is defined in the IMC as follows:

RADIANT HEATER. A Heater designed to transfer heat primarily by direct radiation.

CE134-13

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

C402.2.8-EC-WILLIAMS.doc

CE135 – 13
C202 (NEW), C402.2.9 (NEW), Table C402.2.9 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C402.2.9 Continuous insulation equivalent. Roof, wall and floor assemblies required by Table C402.2 to include continuous insulation are permitted to utilize the alternate nominal R-values listed in Table C402.2.9, in compliance with the following:

1. The cross-sectional area of metal penetrations of otherwise continuous insulation, as measured in the plane of the surface, is equal to or greater than 0.04 percent, but less than 0.08 percent, of the opaque surface area of the assembly.

2. The metal penetrations of otherwise continuous insulation are isolated or discontinuous. No continuous metal elements penetrate the otherwise continuous portion of the insulation.

3. Construction drawings shall contain details showing the locations and dimensions of all the metal penetrations of otherwise continuous insulation. In addition, calculations shall be provided showing the ratio of the cross-sectional area of metal penetrations of otherwise continuous insulation to the overall opaque wall area.

TABLE C402.2.9
CONTINUOUS INSULATION REQUIREMENTS

Assemblies with continuous insulation	Alternate option for assemblies with metal penetrations greater than 0.04% but less than 0.08% of assembly surface
R-11.4ci	R-14.3
R-13.3ci	R-16.6
R-15.2ci	R-19.0
R-30ci	R-38
R-38ci	R-48
R-13 + R7.5ci	R-13 + R9.4
R-13 + R10ci	R-13 + R12.5
R-13 + R12.5ci	R-13 + R15.6
R-13 + R13ci	R-13 + R16.3
R-19 + R8.5ci	R-19 + R10.6
R-19 + R14ci	R-19 + R17.5
R-19 + R16ci	R-19 + R20
R-20 + R3.8ci	R-20 + R4.8
R-21 + R5ci	R-21 + R6.3

Add new definition as follows:

CONTINUOUS INSULATION (ci): Insulation that is continuous across all structural members without thermal bridges, other than service openings and penetrations by metal fasteners with a cross-sectional area, as measured in the plane of the surface, of less than 0.04 percent of the opaque surface area of the assembly. The insulation is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

Reason: This code change confronts the problem of thermal bridging, and ensures that the full intended insulating value of continuous insulation is achieved.

The proposed new Section 402.2.9 and Table C402.2.9 clarify the definition of "continuous insulation" by setting a maximum allowable ratio of metal penetrations, and provide an alternate path for insulation that is penetrated by heavier fasteners. It is based on a 2011 ASHRAE research project by Morrison Hershfield (RP-1365) providing measured values for thermal performance of penetrations through continuous insulation. A similar modifying factor has been in use in Seattle and Washington State for several years.

Cost Impact: The code change proposal will not increase the cost of construction.

CE135-13

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

C402.2T-EC-NOGLER.doc

CE136 – 13
C402.3, C402.3.4 (NEW), Table C402.3.4 (NEW), Table C407.5.1(1)

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with this section, including the prescriptive values in Table C402.3 and Table C402.3.4. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

C402.3.4 Minimum VT. The minimum visible transmittance (VT) for vertical fenestration and skylights in all climate zones shall be as specified in Table C402.3.4.

> **Exception:** Buildings where the vertical fenestration products collectively have an area-weighted average VT equal to or greater than the alternative minimum VT (VT_{alt}) calculated in accordance with Equation C4-3.
>
> $VT_{alt} = 0.11/FWR$ **(Equation C4-3)**
>
> where:
>
> FWR = Fenestration to Wall Ratio which shall be equal to the actual fenestration area of the proposed building divided by the gross above-grade wall area (expressed as a decimal), but shall not exceed the maximum fenestration area as a percent of gross above-grade wall area allowed in Section C402.3.1.

TABLE C402.3.4
FENESTRATION MINIMUM VT

FENESTRATION TYPE	MINIMUM VT
All Climate Zones	
Vertical Fenestration:	
Fixed	0.42
Operable	0.32
Curtain wall/storefront	0.46
Glazed entrance doors	0.17
Skylights	0.49

~~C402.3.4~~ C402.3.5 Area-weighted average *U*-factor and VT. An area-weighted average shall be permitted to satisfy the *U*-factor requirements for each fenestration product category listed in Table C402.3 and the VT requirements for each fenestration product category listed in Table C402.3.4. Individual fenestration products from different fenestration product categories listed in Table C402.3 or Table C402.3.4 shall not be combined in calculating area-weighted average *U*-factor or VT, respectively.

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing	Area 1. The proposed glazing area; where the proposed glazing area is less	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	than 40 percent of above-grade wall area. 2. 40 percent of above-grade wall area; where the proposed glazing area is 40 percent or more of the above-grade wall area. *U*-factor: from Table C402.3 SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used <u>VT: from Table C402.3.4</u> External shading and PF: None	As proposed As proposed <u>As proposed</u> As proposed
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly. 2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly. *U*-factor: from Table C402.3 SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used <u>VT: from Table C402.3.4</u>	As proposed As proposed As proposed <u>As proposed</u>

Reason: The purpose of this proposal is to establish minimum visible transmittance (VT) requirements for commercial fenestration in the *IECC*. This proposal will establish in the *IECC* the same level of minimum VT performance criteria that have been approved and will take effect under California's most recently-revised building energy code, Title 24 *Building Energy Efficiency Standards*, starting in January 2014. The proposal also contains certain provisions, such as weighted averaging and an alternative compliance option based on an equation reflecting fenestration to wall ratio, that were adopted by California to provide flexibility in compliance approaches.

It is well understood that windows are the source of significant solar heat gain, particularly in commercial structures, which have significant internal and external heat gains. Even in colder climates, cooling energy use is typically the most significant load for commercial structures. Due to this fact, most commercial energy codes, including the *IECC*, have appropriately focused on establishing low SHGCs to reduce air conditioning loads, resulting in lower peak energy use and lower electrical peak demand (note that we have another proposal to lower SHGCs in climate zones 4 – 6). Traditional solutions to blocking solar gain sacrificed visible light by allowing the use of dark glazing because of limited glazing options that were available at the time; however, because of technological improvements over the last decade, windows with low SHGC and high VT are now widely available. Thus, this proposal is intended to ensure that reasonable levels of natural light are also available inside the building (or at least that the building capture energy savings associated with such levels) by establishing a minimum VT performance requirement.

Historically, model building codes have required minimum glazing area for these and other reasons. The International Building Code, for example, in Section 1205.2, requires a minimum net glazed area of at least 8% of the floor area of the room served. This is to ensure, among other things, that natural light is provided to spaces intended for human occupancy. However, these values were set based primarily on clear glass, with much higher VTs. In fact, given much lower VTs for fenestration in many commercial buildings, there was a significant debate in the 2012 IECC code cycle over perceived problems to reducing maximum glazing area to 30% in the prescriptive path based on the perceived need for more glazing for daylighting. As our nation's energy codes continue to move to implement criteria for reducing unwanted solar heat gain, setting reasonable VT minimums is a simple measure that will ensure that windows perform as intended to provide natural light, while at the same time reduce solar gain. Ideally, energy codes should establish balanced criteria to address SHGC and VT that are designed to ensure that only the part of the sun's energy useful for daylighting enters the building. This proposal is an effort in that direction.

Achieving this balanced glazing performance (between low SHGC and high VT) was a driving force behind California's implementation of minimum VT requirements (at the same time, California set low SHGC requirements statewide). In 2009, California commissioned a series of Codes and Standards Enhancement Initiative ("CASE") studies to identify opportunities for improvements and efficiency in its Title 24 Building Energy Efficiency Standards. One such CASE Study, entitled "Nonresidential and High-Rise Residential Fenestration Requirements," evaluated and substantiated the establishment of a minimum VT requirement, along with a related CASE Study on daylighting. The California CASE Studies concluded that setting a prescriptive minimum VT ensures maximum natural lighting and minimum artificial lighting for the energy baseline, and it is the simplest and most effective metric in the context of a prescriptive compliance approach.

The CASE Studies found that the more visible light that is provided through fenestration, the more likely internal electric lighting and resulting electric loads are reduced at peak times during the day, which provides a series of benefits beyond the obvious lighting electricity reductions, such as reduced cooling loads due to lower internal heat generated from lighting and, therefore, reduced cooling energy use to offset the lighting heat load and associated lower peak demand. The CASE study authors also found that "the VT requirement is predicted to give occupants a better connection to the outdoors, which has been shown to improve occupant comfort and productivity" (CASE Study, Nonresidential and High-Rise Residential Fenestration Requirements, page 10, note e). The California Energy Commission used the results of these CASE Studies and several months of stakeholder review and comments and staff workshops that followed to further develop, refine and adopt new Title 24 Building Energy Efficiency Standards with minimum prescriptive VT requirements. Starting January 2014, all new nonresidential and high-rise residential buildings and hotels/motels in California must meet or exceed the minimum VT requirements in this proposal.

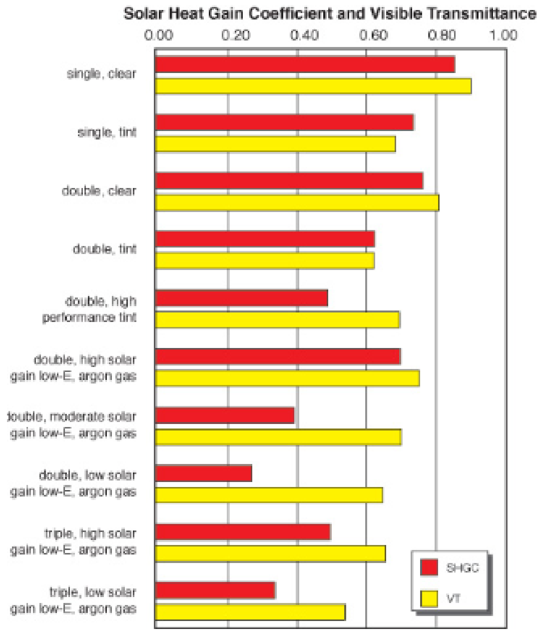
The ideal type of glazing technology capable of meeting the VT requirements in this proposal is referred to by some in the industry as "triple-silver" low SHGC low-e glazing. Triple-silver coatings in a double-pane insulating glass unit provide excellent solar heat gain reduction without losing nearly as much visible light as other glazing types or shading approaches. A triple-silver coating is produced by multiple glazing manufacturers for both residential and nonresidential applications, and is widely available from commercial and residential fenestration manufacturers and contractors across the country. The benefit of a product like triple-silver low-e glazing is that it represents the best available combination of low SHGC, low U-factor and high VT at roughly the same cost to the user as glazing with a low SHGC and low VT. In other words, the visible light benefits can be obtained at little or no additional cost. The minimum VT requirements in this proposal will ensure that the *IECC* calls for the right glazing choice at the time the windows are installed. Even if controls and other techniques are not implemented at initial construction to maximize daylighting benefit, the minimum VT will still provide benefits. A minimum reasonable VT presents a greater opportunity for effective future retrofits of controls and other techniques, as well as increasing the likelihood of voluntary non-automatic lighting reduction by occupants.

The life-cycle costing analysis used by California in its CASE Studies substantiated that "double-pane triple-silver low-e coated glazing was the most cost-effective choice for a statewide fenestration standard" (CASE Study, Nonresidential and High-Rise Residential Fenestration Requirements, page 33).

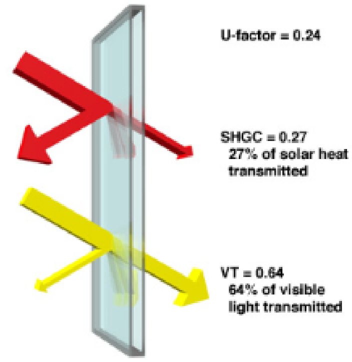
The following graphic from the Efficient Window Collaborative's website compares and contrasts the solar heat gain reduction and visible light transmitting characteristics of various glazing types. As you can see from this graphic, double-pane, low solar gain (triple-silver) low-e glazing (the eighth option on the list) provides the best combination of low SHGC and high VT of standard glazing types. Note that the values in the graphic are for glass only without the frame – actual SHGCs and VTs for code compliance include the effects of frames, which will typically reduce both the SHGC and VT by at least 10%.

Benefits: Increased Light & View

Daylight and view are two of the fundamental attributes of a window. Unfortunately, windows can also be the source of significant solar heat gain during times when it is unwanted. Traditional solutions to reducing solar heat gain such as tinted glazing or shades mean that the amount of light is reduced as well. New glazings with low-solar-gain Low-E (spectrally selective) coatings can provide better solar heat gain reduction than tinted glass, with a minimal loss of visible light. This also means that views can be clearer and unobstructed.



Note: All values are for glass only without frame. Source: Residential Windows by Carmody, Selkowitz, Arasteh and Heschong.



Performance of Double-Glazed Low-Solar-Gain Low-E Glass (Spectrally Selective) and Argon Gas Fill

Verifying fenestration VT for code compliance will not add to cost or complexity. VT is simply another number to check that is already listed on the NFRC label, along with U-factor and SHGC. Also, *IECC* Table C303.1.3(3) already includes default VT values for products without NFRC ratings.

During California's most recent code adoption process, some commenters were concerned about glare being a problem associated with a minimum VT requirement. There was much evidence presented (by the California CASE Study authors and others) that refuted any suggestion that higher VTs lead to increased glare. Instead, it was shown that glare could be present regardless of a fenestration product's VT rating, and it is something best addressed through design, not VT.

Other options California considered for establishing minimum visible light criteria included effective aperture (EA) and light-to-solar gain ratio (referred to as LSG or VT/SHGC). California dismissed those as less effective alternatives, and we agree. Focusing first on EA, most daylighting experts agree that EA is overly complicated and unnecessary. The EA approach analyzed in California uncovered a technical loophole and energy penalty that made EA inferior to VT or VT/SHGC. The CASE Study noted "the reason that the EA approach is an energy penalty is that it results in low VTs at crucial WWRs" (CASE Study, Nonresidential and High-Rise Residential Fenestration Requirements, page 37). (Crucial WWRs, or window-to-wall ratios, are ones at or near 30%.) The CASE Study found that the EA penalty could be minimized by adding the complexity of more rules to the code, but such complexity would have been contrary to California's stated goal of simplification. An EA approach also would be contrary to the simplification improvements that the *IECC* has achieved over past cycles.

The second analyzed option of an LSG or VT/SHGC ratio would satisfy a simplification goal, because it relies on two readily available window performance metrics (VT and SHGC), but the same benefits with less complexity can be accomplished by simply setting a minimum VT. Those who supported the VT/SHGC approach in California seemed more interested in adopting the extremely weak 1.1 ratio that is presently required in limited applications in the *IECC* (Section C402.3.1.1(3)), as opposed to any particular reason why the LSG ratio approach would be better than simply setting a minimum VT. The problem with 1.1 VT/SHGC ratio is that it is not a particularly robust or effective target. If a VT/SHGC or LSG ratio approach were implemented in the *IECC*, the ratio would need to be much higher than 1.1 to achieve the same level of performance that California adopted. As an example, using a triple-silver low SHGC low-e glass that is available in today's market as a reference point, the VT/SHGC ratio would exceed 2.0.

To allow flexibility and a greater array of products to qualify, while preserving the core of the VT requirement and associated daylighting savings, several allowances are included in this proposal to match what was adopted in California. First and foremost, in California and in this proposal, the minimum VT is established as the prescriptive path energy baseline for the performance path. The prescriptive VT can be traded away in the performance path, so long as comparable energy savings are provided. Any glazing or combination of measures that deliver equivalent savings would be allowed, which provides the greatest flexibility. Also, as in California, this proposal allows the minimum VT requirements to be met on an area-weighted average basis, which permits some glass not to meet the minimum, so long as the glass meets the minimum on average. Lastly, this proposal includes as an exception, California's equation approach, as an alternative to the prescriptive VT values as a way to provide additional flexibility for buildings with higher glazing areas (Alternative Minimum VT = 0.11/FWR). California viewed this equation as a temporary option that likely will be removed in the next Title 24 rulemaking cycle.

It is also worth noting that the minimum prescriptive VT values that California's CASE Study initially substantiated and recommended were considerably more stringent than the values that were ultimately adopted and are being proposed here. The California Energy Commission Staff took into consideration several factors and comments throughout its rulemaking process, and the minimum prescriptive values and approaches ultimately settled upon in California were found to be sufficient for a reasonable group of products to qualify while still providing the daylighting benefits and savings that California set out to achieve.

While we too would have constructed a more stringent set of requirements if we were starting from scratch, we believe that adopting this fully-developed and soon-to-be-implemented approach from California, with its already built-in compromises, would be the best course to make real progress at this point on a national basis and hopefully garner additional support and avoid controversy. On balance, we think that additional refinements would best be considered in future code cycles.

In summary, adoption of the minimum VT requirements in this proposal will ensure that fenestration capable of meeting the *IECC's* insulating and solar gain performance requirements will not needlessly sacrifice visible light. The level of performance in this proposal can be met cost-effectively by existing readily available glazing technology. These proposed performance values will establish in the *IECC* the appropriate technology targets for high performance glazing that will generate significant cooling, heating and lighting energy savings.

Bibliography: Codes and Standards Enhancement Initiative (CASE), Nonresidential & High-Rise Residential Fenestration Requirements, 2013 California Building Energy Efficiency Standards, California Utilities Statewide Codes and Standards Team, September 2011.

http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/Envelope/2013_CASE_NR_Fenestration_Reqs_Sept_2011.pdf

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

CE136-13

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

C402.3-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE137 – 13

C202 (NEW), C402.3, C402.3.1.1, C402.3.1.2, C402.3.2.1, C402.3.3.3, C402.3.3.4, Table C406.3, C408.3.1

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. ~~Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.~~ <u>*Daylight responsive controls* shall comply this section and Section C405.2.2.3.2.</u>

C402.3.1.1 Increased vertical fenestration area with ~~daylighting controls~~ <u>daylight responsive controls</u>. In Climate Zones I through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. ~~Automatic daylighting controls~~ <u>*Daylight responsive controls*</u> are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

   Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with ~~daylighting controls~~ <u>daylight responsive controls</u>. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided ~~automatic daylighting controls~~ <u>*daylight responsive controls*</u> are installed in daylight zones under skylights.

C402.3.2.1 Lighting controls in daylight zones under skylights. ~~All lighting in the daylight zone shall be controlled by multilevel lighting controls that comply with Section C405.2.2.3.3.~~ <u>*Daylight responsive controls* shall be provided to control the electric lights within *daylight zones* under skylights.</u>

~~**Exception:** Skylights above daylight zones of enclosed spaces are not required in:~~

1. ~~Buildings in Climate Zones 6 through 8.~~
2. ~~Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).~~
3. ~~Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.~~
4. ~~Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.~~

C402.3.3.3 Increased skylight SHGC. In Climate Zones 1 through 6, skylights shall be permitted a maximum SHGC of 0.60 where located above daylight zones provided with ~~automated daylighting controls~~ <u>*daylight responsive controls*</u>.

C402.3.3.4 Increased skylight *U*-factor. Where skylights are installed above daylight zones provided with ~~automated daylighting controls~~ <u>*daylight responsive controls*</u>, a maximum <u>*U*</u>-factor of 0.9 shall be permitted in Climate Zones 1 through 3; and a maximum *U*-factor of 0.75 shall be permitted in Climate Zones 4 through 8.

TABLE C406.3
REDUCED INTERIOR LIGHTING POWER

(*Portions of Table not shown remain unchanged)*

a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.
b. First LPD value applies if no less than 30 percent of conditioned floor area is in daylight zones. ~~Automatic daylighting controls~~ *Daylight responsive controls* shall be installed in daylight zones and shall meet the requirements of Section C405.2.2.3. In all other cases, second LPD value applies.
c. No less than 70 percent of the floor area shall be in the daylight zone. Automatic daylighting controls shall be installed in daylight zones and shall meet the requirements of Section 405.2.2.3.

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or ~~daylighting controls~~ *daylight responsive controls* are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that the placement and sensitivity adjustments of ~~photosensor~~ *daylight responsive controls* reduce electric light based on the amount of usable daylight in the space as specified.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

Reason: The terms "daylighting controls", "automatic daylighting controls", "automated daylighting controls" and "photosensor controls" are used interchangeably throughout the code but not defined. These terms are misleading because the controls they are describing do not control daylight, but rather they control electric lights in response to daylight. "Daylight responsive controls" is proposed to replace all of these terms.

The exceptions to C402.3.2.1 do not make any sense, as they are exceptions to the skylight requirement in the code, but Section C402.3.2.1 refers to daylighting controls, not skylights. The exact same list of exceptions appears under C402.3.2. We believe that including these exceptions under C402.3.2.1 was an unintentional oversight.

Cost Impact: The code change proposal will not increase the cost of construction.

CE137-13

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

C402.3-EC-BAILEY

CE138 – 13
C402.3.1.1, C402.3.2

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone; <u>and</u>
2. Automatic daylighting controls are installed in daylight zones~~; and~~
3. ~~Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).~~

   ~~**Exception:** Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3~~.

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than 10,000 square feet (929 m^2), directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent~~ with a skylight VT of at least 0.40~~; or
2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation C4-1.

Reason: The purpose of the proposed code change is to eliminate potentially unnecessary and inconsistent code provisions. The proposal is intended as a clean-up companion proposal to a separate proposal that would establish minimum VT performance requirements for fenestration under the *IECC* commercial energy efficiency chapter. If the companion proposal is adopted, this proposal would be useful to delete the VT references in these code sections because they would no longer be necessary and could be confusing. For example, the minimum VT for skylights in the companion minimum VT proposal is higher than the VT specified in section C402.3.2. Similarly, the VT/SHGC ratio referenced in section C402.3.1.1 will be unnecessary if the minimum VTs are adopted as proposed in the companion proposal, since the resulting VT/SHGC ratios from the VT minimums can be expected to be substantially higher.

Cost Impact: The code change proposal will not increase the cost of construction.

CE138-13

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

C402.3.1.1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE139 – 13
C402.3, C402.3.1.1, C402.3.1.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. ~~Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.~~

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylighting controls complying with Section C405.2.2.3.2 are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

   Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with daylighting controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided automatic daylighting controls complying with Section C405.2.2.3.2 are installed in daylight zones under the skylights.

Reason: This proposal clarifies daylighting control provisions associated with fenestration and increased skylight area and locate in a more appropriate subsection. The objective of this proposal is to clarify the code to foster implementation and compliance verification.

The primary purpose of the parent Section C402.3 is to introduce the provisions of the code related to fenestration. It is later on in the section that the issue of skylights and an increased skylight area allowance are addressed and the controls provisions then become relevant. The proposal simply locates the relevant daylighting control provisions in the code where they are specifically relevant.

Cost Impact: The code change proposal will not increase the cost of construction.

CE139-13

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

C402.3-EC-WILLIAMS.doc

CE140 – 13
C402.3, Table C402.3

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with <u>Sections C402.3 through C402.3.4 and</u> Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

TABLE C402.3
BUILDING ENVELOPE <u>FENESTRATION MAXIMUM U-FACTOR AND SHGC</u> REQUIREMENTS~~:~~ ~~FENESTRATION~~

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The following revisions are proposed to clarify the application of Table C402.3::

a) The word “maximum” is proposed to be added to the title of Table C402.3. Previously, many users incorrectly assumed that these were minimum values.
b) References to “Sections C402.3 through C402.3.4” were added to the text of Section C402.3 to clarify that these sections must be complied with in addition to the currently referenced Table C402.3 in order to satisfy the codes prescriptive fenestration requirements.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code’s prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: This proposal is a clarification and, as such, will not increase the cost of construction. This code change proposal will not increase the cost of construction.

CE140-13

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

C402.3T #1-EC-THOMPSON-SEHPCAC.doc

CE141 – 13
Table C402.3

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	**1**	**2**	**3**	**4 EXCEPT MARINE**	**5 AND MARINE 4**	**6**	**7**	**8**
Vertical fenestration								
***U*-factor**								
Fixed fenestration	0.50	0.50	~~0.46~~ <u>0.38</u>	0.38	~~0.38~~ <u>0.36</u>	0.36	0.29	0.29
Operable fenestration	0.65	0.65	~~0.60~~ <u>0.45</u>	0.45	~~0.45~~ <u>0.43</u>	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77

(Portions of Table not shown remain unchanged)

Reason: The purpose of the proposed code change is to improve the efficiency of commercial vertical windows in climate zones 3 and 5 by lowering U-factors to the same level as the U-factors in climate zones 4 and 6 respectively. The proposal also simplifies the code requirements for design professionals, manufacturers, and suppliers.

- The changes in U-factors are based on existing U-factor values in the 2012 IECC. These U-factors are reasonable and currently applicable to commercial buildings in climate zones 4 and 6. The proposal simply spreads the values from one climate zone to the next, applying the same U-factor across 2 climate zones.
- This proposal essentially combines climate zones 3-4 and 5-6 for purposes of U-factor requirements. This will produce economies of scale and lower costs for manufacturers, suppliers, and ultimately consumers.
- The lower U-factors in climate zones 3 and 5 will provide greater insulating value resulting in energy savings and comfort. For example, our initial estimate of savings based on US DOE's EnergyPlus office reference buildings and an assumption of 30% fenestration area is in the neighborhood of 1% heating, cooling and hot water energy costs for each zone.
- Improvement in window performance, even incrementally, is particularly important in commercial buildings because of the large amounts of glass used in such buildings.

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

CE141-13

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

C402.3T #2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE142 – 13

Table C402.3, C402.3.3, C402.3.3.1, Table C402.3.3.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov); Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee and Aluminum Extruders Council (culp@birchpointconsulting.com)

Revise as follows:

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
***U*-factor**																
Fixed fenestration	0.50		0.50		0.46		0.38		0.38		0.36		0.29		0.29	
Operable fenestration	0.65		0.65		0.60		0.45		0.45		0.43		0.37		0.37	
Entrance doors	1.10		0.83		0.77		0.77		0.77		0.77		0.77		0.77	
SHGC																
Orientation[a]	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N
~~SHGC~~ PF < 0.2	0.25	0.33	0.25	0.33	0.25	0.33	0.40	0.53	0.40	0.53	0.40	0.53	0.45	NR	0.45	NR
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37	0.30	0.37	0.48	0.58	0.48	0.58	0.48	0.58	NR	NR	NR	NR
PF ≥ 0.5	0.40	0.40	0.40	0.40	0.40	0.40	0.64	0.64	0.64	0.64	0.64	0.64	NR	NR	NR	NR
Skylights																
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR		NR	

NR = No requirement.
a. “N” indicates vertical fenestration oriented within 45 degrees of true north. “SEW” indicates orientations other than “N.” For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.

C402.3.3 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3, based on the window projection factor <u>and orientation</u>. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3.

The window projection factor shall be determined in accordance with Equation 4-2.

$PF = A/B$ **(Equation 4-2)**

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

~~**C402.3.3.1 SHGC adjustment.** Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.2, the required maximum SHGC from Table C402.3 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.3.3.1 corresponding with the orientation of the fenestration product and the projection factor.~~

~~TABLE C402.3.3.1~~
~~SHGC ADJUSTMENT MULTIPLIERS~~

~~PROJECTION FACTOR~~	~~ORIENTED WITHIN 45 DEGREES OF TRUE NORTH~~	~~ALL OTHER ORIENTATION~~
~~0.2 ≤ PF < 0.5~~	~~1.1~~	~~1.2~~
~~PF~~ ≤ 0.5	~~1.2~~	~~1.6~~

Reason:
(Thompson): This proposal is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

This proposal moves and clarifies, but does not delete requirements that are currently contained in Section C402.3.3.1 and Table C402.3.3.1 of the 2012 IECC.

The purpose of this proposal is twofold: correct a technical error in the SHGC shading adjustment, and increase the enforceability and usability of the vertical fenestration requirements.

<u>*Technical Correction*</u>

During review of the 2012 IECC, a technical error was identified in the way the multipliers of the new Table C402.3.3.1 are applied to adjust the SHGC based on shading projections and orientation. When used, Table C402.3.3.1 illogically allows a higher SHGC on the west side of a building than on the north side. For example, with a 3 ft overhang above 6 ft tall glazing on a building in zone 3, this would require a max SHGC of 0.30 on the north where solar loads are low, yet would allow 0.40 SHGC on the west where solar impact on energy efficiency is more critical. The source of the problem is as follows. The multipliers are indirectly based on a similar SHGC adjustment in ASHRAE 90.1, which in turn was based on a technical paper using DOE2 simulations in 12 cities across various climate zones and latitudes (E.P. Kolderup and C.N. Eley Jr, "Evaluating the Impact of Overhangs and Sidefins", ACEEE Summer Study on Energy Efficiency in Buildings, 1992). ASHRAE 90.1 determined that the multipliers could be grouped into two sets of multipliers: one for the south, east, and west (SEW) orientations, and one for the north (N) orientation. At the same time, this was meant to be used together with two sets of SHGC base criteria: one number for the overall building, and a separate number for the north side. This recognized the difference in the solar performance of the north side, and also avoided the technical problem now identified in the 2012 IECC with how the shading adjustments are used.

This was the case in ASHRAE 90.1-2004, but unfortunately, this technical rationale may have been forgotten and both ASHRAE 90.1 and IECC have deviated from this since then. The 2009 IECC avoided the multiplication problem by simply listing the required SHGC for different shading levels (projection factor PF), but did not address the difference between north and the other sides. On the other hand, ASHRAE 90.1-2007 and 2010 kept the different shading factors for SEW and N, but dropped the different baseline SHGC for the north in an effort to simplify – and as a result, they now contain the same technical error as 2012 IECC. This proposal aims to correct the error for the IECC, and the issue will also be raised at ASHRAE 90.1.

This proposal restores the basic format of the 2009 IECC where the required SHGC is directly listed for the appropriate climate zone and projection factor, but also reinstates the different SHGC criteria for the north side. While adding some rows, this table format improves usability and enforcement by allowing the required SHGC to be simply read from the main fenestration table instead of involving a separate table and calculation. There is no change in the 2012 baseline SHGC criteria, but the SEW multipliers are applied to directly show the adjusted SHGC for different shading levels ($0.2 \le PF < 0.5$ and $PF \ge 0.5$) for the SEW orientations. Then, matching the adjusted SHGC requirement for N and SEW orientations for this high PF well shaded window, the SHGC requirements for the north side are then calculated at $0.2 \le PF < 0.5$ and $PF < 0.2$ using the same multipliers. This ensures consistency, corrects the technical error of requiring higher SHGC on the west than on the north, and also accounts for the different solar performance of northern orientations.

Additionally, the footnote is added to clarify what to do if located in the southern hemisphere or near the equator. The northern multipliers do not apply well between the Tropics of Cancer and Capricorn (23.5 degrees latitude), and the SEW multipliers are more appropriate for all orientations. (Think of it this way: there is no difference between north and south in terms of the sun when standing at the equator.

Improved Usability and Enforcement

In addition to correcting the technical error, a very important aspect of this proposal is to improve usability and enforcement of the code. Concerns have been expressed about the increased complexity for enforcement with the format of the 2012 IECC, as compared to the 2009 and 2006 IECC. Rather than simply looking up the maximum SHGC for a given projection factor on the main prescriptive table, the 2012IECC forces extra unnecessary steps on the user, referring to a separate table and requiring additional calculations. This increases both the workload and potential for error in code compliance checks. This proposal simplifies the process by allowing the code official to simply look up the required SHGC on the main fenestration table, similar to the 2006 and 2009 IECC. This simplifies enforcement and compliance, makes it easy to determine the baseline value in performance path calculations, and improves overall usability of the code. Also, while SHGC requirements for the northern orientation have been added to make this section technically correct, this does not necessarily add complexity – users can still simply comply with one glass type and SHGC by meeting the main SHGC requirement for the SEW orientation (which is lower or equal to the N requirement in all cases).

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

(Culp): The purpose of this proposal is twofold: correct a technical error in the SHGC shading adjustment, and increase the enforceability and usability of the vertical fenestration requirements.

Technical Correction

During review of the 2012 IECC, a technical error was identified in the way the multipliers of the new Table C402.3.3.1 are applied to adjust the SHGC based on shading projections and orientation. When used, Table C402.3.3.1 illogically allows a higher SHGC on the west side of a building than on the north side. For example, with a 3 ft overhang above 6 ft tall glazing on a building in zone 3, this would require a max SHGC of 0.30 on the north where solar loads are low, yet would allow 0.40 SHGC on the west where solar impact on energy efficiency is more critical. The source of the problem is as follows. The multipliers are indirectly based on a similar SHGC adjustment in ASHRAE 90.1, which in turn was based on a technical paper using DOE2 simulations in 12 cities across various climate zones and latitudes (E.P. Kolderup and C.N. Eley Jr, "Evaluating the Impact of Overhangs and Sidefins", ACEEE Summer Study on Energy Efficiency in Buildings, 1992). ASHRAE 90.1 determined that the multipliers could be grouped into two sets of multipliers: one for the south, east, and west (SEW) orientations, and one for the north (N) orientation. At the same time, this was meant to be used together with two sets of SHGC base criteria: one number for the overall building, and a separate number for the north side. This recognized the difference in the solar performance of the north side, and also avoided the technical problem now identified in the 2012 IECC with how the shading adjustments are used.

This was the case in ASHRAE 90.1-2004, but unfortunately, this technical rationale may have been forgotten and both ASHRAE 90.1 and IECC have deviated from this since then. The 2009 IECC avoided the multiplication problem by simply listing the required SHGC for different shading levels (projection factor PF), but did not address the difference between north and the other sides. On the other hand, ASHRAE 90.1-2007 and 2010 kept the different shading factors for SEW and N, but dropped the different baseline SHGC for the north in an effort to simplify – and as a result, they now contain the same technical error as 2012 IECC. This proposal aims to correct the error for the IECC, and the issue will also be raised at ASHRAE 90.1.

This proposal restores the basic format of the 2009 IECC where the required SHGC is directly listed for the appropriate climate zone and projection factor, but also reinstates the different SHGC criteria for the north side. While adding some rows, this table format improves usability and enforcement by allowing the required SHGC to be simply read from the main fenestration table instead of involving a separate table and calculation. There is no change in the 2012 baseline SHGC criteria, but the SEW multipliers are applied to directly show the adjusted SHGC for different shading levels (0.2 ≤ PF < 0.5 and PF ≥ 0.5) for the SEW orientations. Then, matching the adjusted SHGC requirement for N and SEW orientations for this high PF well shaded window, the SHGC requirements for the north side are then calculated at 0.2 ≤ PF < 0.5 and PF < 0.2 using the same multipliers. This ensures consistency, corrects the technical error of requiring higher SHGC on the west than on the north, and also accounts for the different solar performance of north orientations.

Additionally, the footnote is added to clarify what to do if located in the southern hemisphere or near the equator. The northern multipliers do not apply well between the Tropics of Cancer and Capricorn (23.5 degrees latitude), and the SEW multipliers are more appropriate for all orientations. (Think of it this way: there is no difference between north and south in terms of the sun when standing at the equator.)

Improved Usability and Enforcement

In addition to correcting the technical error, a very important aspect of this proposal is to improve usability and enforcement of the code. Concerns have been expressed about the increased complexity for enforcement with the format of the 2012 IECC, as compared to the 2009 and 2006 IECC. Rather than simply looking up the maximum SHGC for a given projection factor on the main prescriptive table, the 2012 IECC forces extra unnecessary steps on the user, referring to a separate table and requiring additional calculations. This increases both the workload and potential for error in code compliance checks. This proposal simplifies the process by allowing the code official to simply look up the required SHGC on the main fenestration table, similar to the 2006 and 2009 IECC. This simplifies enforcement and compliance, makes it easy to determine the baseline value in performance path calculations, and improves overall usability of the code. Also, while SHGC requirements for the north orientation have been added to make this section technically correct, this does not necessarily add complexity – users can still simply comply with one glass type and SHGC by meeting the main SHGC requirement for the SEW orientation (which is lower or equal to the N requirement in all cases).

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is cost neutral as it is an optional trade-off only.

CE142-13

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

C402.3T-EC-THOMPSON-SEHPCAC-CULP

CE143 – 13
C202 (NEW), Table C402.3

Proponent: Shaunna Mozingo, City of Cherry Hills Village, Colorado Code Consulting, representing self. (smozingo@coloradocode.net)

Revise as follows:

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration								
***U*-factor**								
Nonmetal framing (all)	0.50	0.40	0.35	0.35	0.32	0.32	0.29	0.29
~~Fixed fenestration~~ Metal framing, fixed	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
~~Operable fenestration~~ Metal framing, operable	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Metal framing, entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC (all frame types)								

(Portions of Table not shown remain unchanged)

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

FENESTRATION, METAL FRAMING. Fenestration products using metal framing with or without thermal breaks.

FENESTRATION, NONMETAL FRAMING. Fenestration products using framing materials other than metal, with or without metal reinforcement or cladding.

FENESTRATION, FIXED. Vertical fenestration other than *operable fenestration* and *entrance doors* including, but not limited to, curtain wall, storefront, window walls, fixed windows, and picture windows.

FENESTRATION, OPERABLE. Vertical fenestration that opens, except *entrance doors.*

Reason: While I understand the reason the proponent of the table change submitted it for the 2012 IECC to go from windows classified by framing type to windows classified by whether they are fixed or operable, I definitely disagreed with it then and do so even more now that I have had to work with it as a code requirement. Code users are not looking for something as simple as fixed/operable as much as they are the types of framing because that is what we use everywhere else in this code. We have been taught that there is a real difference in metal framing verses all other types of window frames, and that we need to pay attention to the U-factors we are seeing. Now when we take away that framing issue and just say fixed/operable, it looks like framing type no longer matters, so we will go back to not verifying, going backwards in compliance as well as efficiency.

In reality, what is on paper and what happens in the field are two very different things. I am very much for energy efficiency. I have been saying for years that commercial windows are the least complied with requirement of the energy code because they don't usually have the handy labels on the windows and so few take the time to verify NFRC compliant certification. Very few will hold up a Certificate of Occupancy based on a U-Factor not being verified. I know what is being enforced in a lot of jurisdictions, and I know that if we make it sound like all windows are created equal then the code officials will go back to their way of not worrying about it, and all of our hard work on educating them will have gone out the "metal framed window". A very large number of jurisdictions across the U.S. do absolutely nothing for verifying commercial windows other than seeing that something is listed on ComCheck, and then only half of those make sure that the U-Factor on ComCheck is within in the correct range for the type of framing. Many designers put the U-Factor in as the last item on a ComCheck and put whatever value will get it to pass, knowing full well that the jurisdiction will not verify it at plan review, and if they do, it won't get verified in the field. Ask NFRC how many certificates actually get requested.

The definition of U-Factor doesn't do enough to let the user know that we are not dealing with just center of glass here. It's the entire assembly that gets calculated together to create the U-Factor for this code. The code language in Chapter 3 states that U-Factor is calculated in accordance with NFRC 100. But there are hundreds of referenced standards and testing items in the codes, and I can absolutely tell you that the code official doesn't own them all or read them all, and many will not know or understand that NFRC 100 is for the whole assembly, glass and framing. They need something simple that lets them know that the framing materials matter when it comes to U-Factor, and by taking the table and converting it from framing materials to just fixed/operable, that one piece of information went away.

The default tables in Chapter 3 are based on framing materials and we are taught to figure out what the framing material is so that we can determine a conservative U-Factor and SHGC in the absence of a label or certification. We would need to change the default tables to match the table in Chapters C and R 4 if we are going to keep this new way of determining these values. But you can see by looking in these default tables that framing does matter, and not all windows should be treated as equal.

You can absolutely get a metal framed window to meet the same U-Factor of a window of different framing; it will just cost a lot more. There are structural reasons where metal framed windows are required and in these instances we will be forcing higher costs on the owner because these metal windows will cost a lot more in order to get these lower U-Factors out of them.

What has been proposed here is not exactly the same format as 2009 IECC but is consistent with the format of ASHRAE 90.1-2013. It makes the table a little cleaner than 2009 IECC, putting some of the language in the definitions. But it also uses metal fixed and metal operable, as opposed to metal curtain wall / storefront and metal all other. The main reason ASHRAE did this was because fixed punched opening windows (e.g. strip windows and picture windows) now fall under the more stringent fixed category, as opposed to the less stringent "all other" category, which was really intended to cover operable windows.

For nonmetal U-factors, I used the 2012 residential U-factors, except there is a question about zone 7-8. The residential chapter has 0.32, but the commercial chapter has 0.29 for metal framed fixed products. I chose not to take the nonmetal values from the residential values because it would have made the nonmetal values less stringent than the metal values, which currently requires triple glazing. So I adjusted them to 0.29 on the rationale of staying at least as stringent.

Cost Impact: These glazing values are already realized in the residential portion of the code but if just dealing with commercial buildings, there will be an increase in cost for the more efficient non-metal framed windows because the values were brought up to match those in the residential section.

CE143-13

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

C402.3T-EC-MOZINGO.doc

CE144 – 13

C202 (NEW), Table C402.3

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Aluminum Extruders Council (culp@birchpointconsulting.com)

Revise as follows:

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
***U*-factor**								
Performance Class R[a]	0.50	0.40	0.35	0.35	0.32	0.32	0.29	0.29
Performance Class LC, CW, AW and fenestration outside scope of AAMA/WDMA/CSA 101/I.S.2/A440[a]:								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
***U*-factor**	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
a. Performance class determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

FENESTRATION, FIXED. Vertical fenestration other than *operable fenestration* and *entrance doors* including, but not limited to, curtain wall, storefront, window walls, fixed windows, and picture windows.

FENESTRATION, OPERABLE. Vertical fenestration that opens, except *entrance doors*.

Reason: The purpose of this proposal is twofold: (1) correct a *decrease* in energy efficiency that inadvertently occurred when the table format was changed in the last cycle, and (2) restore the distinction for different product types used in the diverse range of commercial buildings. First, when the table format was changed at the final action hearings last cycle, it was to establish much more stringent U-factors that could still be achieved by structural metal framed windows, albeit at significantly higher cost, while simplifying the window types down to just fixed vs. operable windows. However, while this was focused on metal framed products that make up 91% of commercial fenestration because of structural and durability performance, this neglected to account for nonmetal residential-style windows that are used in multifamily and light commercial buildings that also fall under the commercial code. For those buildings that would have used these products anyway, the U-factor actually *increased* by 9 - 41% compared to the 2012 residential values (e.g. in zone 5, the U-factor was increased from 0.32 up to 0.38 for fixed windows and 0.45 for operable windows). This resulted in free trade-off credit for something that was going to be done anyway, increasing the overall energy use in these types of buildings.

Second, since first introduced by the New Buildings Institute in 2004, the commercial fenestration requirements have made a distinction between residential-style windows going into multifamily and light commercial buildings, and heavier commercial windows used for structural and durability purposes. This established a fair playing field in that the architect will select the window and framing type based on many building performance considerations, and then each category set an overall U-factor (whole assembly, glazing plus framing) appropriate for that product type that ensures each product uses a comparable energy efficient glazing package. In other words, make each product type have to use similar energy efficiency measures (low-e, argon, better spacers, etc) to meet the requirement. However, as it stands without that distinction, the current table not only favors less structural products, but also, lighter residential-style windows can get away with a less efficient glazing package.

The 2006 and 2009 IECC used the simplest distinction – metal and nonmetal framed products. This was simple to understand and simple for code enforcement. However, some groups have voiced concerns that using metal vs. nonmetal fenestration frame categories is not "material neutral". We do not agree with those statements, in that there are specific technical reasons for having separate frame categories, and there is nothing inherently wrong with having separate requirements based on material. Material-based requirements are common throughout the I-codes (e.g. wood, metal, and mass wall requirements).

Nonetheless, in a positive effort to address these concerns, we offer this option that does not use metal vs. nonmetal frame categories, yet preserves the original reason for having separate metal vs. nonmetal categories – structural performance. This proposal uses the "R" performance class from the North American Fenestration Standard (AAMA/WDMA/CSA 101/I.S.2/A440) to set U-factors for the residential-style windows, and then uses the existing U-factors for all other products (performance classes LC, CW, and AW, as well as products outside the scope of AAMA/WDMA/CSA 101/I.S.2/A440 such as curtain wall and storefront). R stands for residential, LC for light commercial, CW for commercial window, and AW for architectural window, with increasing test requirements for each class. This performance class data is already available to the code official in that AAMA/WDMA/CSA 101/I.S.2/A440 testing is already required by the IBC, and for air leakage in the IECC. AAMA/WDMA/CSA 101/I.S.2/A440 testing, which is for the whole product including both framing and glazing, will also help reinforce that the U-factors are not just center-of-glass but must account for the whole product.

The U-factors in the Performance Class R category were taken from the 2012 IECC residential code, except modified to 0.29 in zones 7-8 where the commercial code is already more stringent. This restores the distinction and level playing field for different products while also correcting the decrease in the stringency that occurred last cycle for residential-style products.

Cost Impact: This proposal will increase the cost of construction relative to the current commercial code, but not relative to residential-style windows already established by the residential code for zones 1-6.

CE144-13

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

C402.3T #2-EC-CULP.doc

CE145 – 13
Table C402.3

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	**1**	**2**	**3**	**4 EXCEPT MARINE**	**5 AND MARINE 4**	**6**	**7**	**8**
Vertical fenestration								
SHGC								
SHGC	0.25	0.25	0.25	~~0.40~~ 0.25	~~0.40~~ 0.25	~~0.40~~ 0.25	0.45	0.45

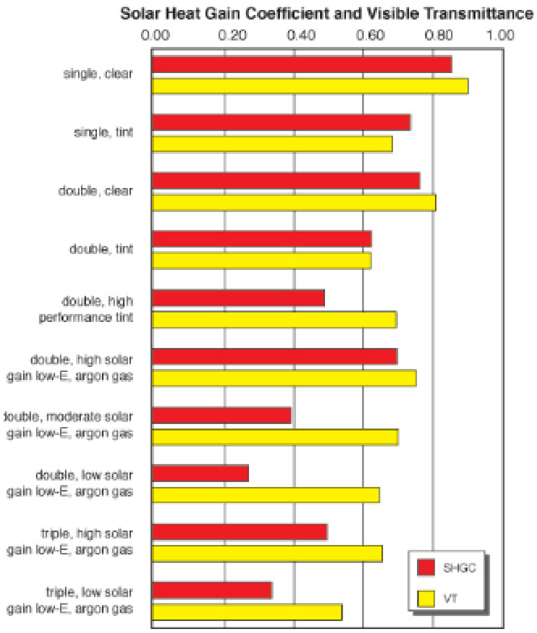
(Portions of Table not shown remain unchanged)

Reason: The purpose of the proposed code change is to strengthen the SHGC requirement for vertical fenestration in climate zones 4 - 6 from 0.40 to 0.25, thereby increasing the energy efficiency of vertical fenestration in these climates.

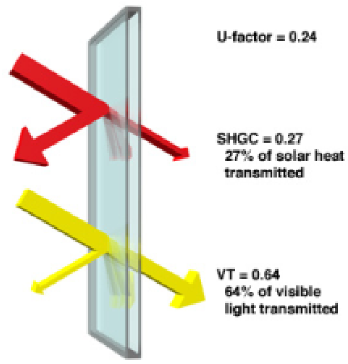
Low solar heat gain fenestration is even more critical for commercial buildings than residential buildings in all climate zones because commercial buildings tend to be internal heat load dominated, and require cooling during far more hours. Recognizing this fact, the code currently requires some degree of solar control in commercial buildings in all climate zones, by requiring an SHGC of 0.45 or less even in climate zones 7 - 8, 0.40 or less in climate zones 4 – 6; and 0.25 or less in climate zones 1 - 3. When the 0.40 maximum was established for climate zones 4 - 6, a consideration that may have justified the higher SHGC was the reduction in visible light that came with lower SHGC glazing at that time. However, this issue has since been addressed with the introduction of low SHGC glass with much higher visible light transmission resulting from optimizing control of solar gain outside of the visible light spectrum. As a result, lower SHGCs have already been established for homes in climate zones 1 -3 (dropping from 0.40 SHGC in the 2006 *IECC* to 0.25 in the 2012 *IECC*). A similar benefit can be captured for commercial buildings in climate zones 4 – 6 by setting the maximum SHGC at 0.25 for these climate zones. The level of solar heat gain, whether 0.40 or 0.25, is simply a choice of low-e coatings and does not involve significant increases in cost; there is no good reason not to capture the benefit of reducing the requirement to 0.25. The Efficient Windows Collaborative (“EWC”) shows how low solar gain, low U-factor and high visible light can now be achieved with improved glazings (see the graphic from their website below; note that these are glass-only values; since NFRC ratings also factor in frames, the reported SHGC and VT can be expected to be at least 10% lower):

Benefits: Increased Light & View

Daylight and view are two of the fundamental attributes of a window. Unfortunately, windows can also be the source of significant solar heat gain during times when it is unwanted. Traditional solutions to reducing solar heat gain such as tinted glazing or shades mean that the amount of light is reduced as well. New glazings with low-solar-gain Low-E **(spectrally selective)** coatings can provide better solar heat gain reduction than tinted glass, with a minimal loss of **visible light**. This also means that views can be clearer and unobstructed.



Note: All values are for glass only without frame. Source: Residential Windows by Carmody, Selkowitz, Arasteh and Heschong.

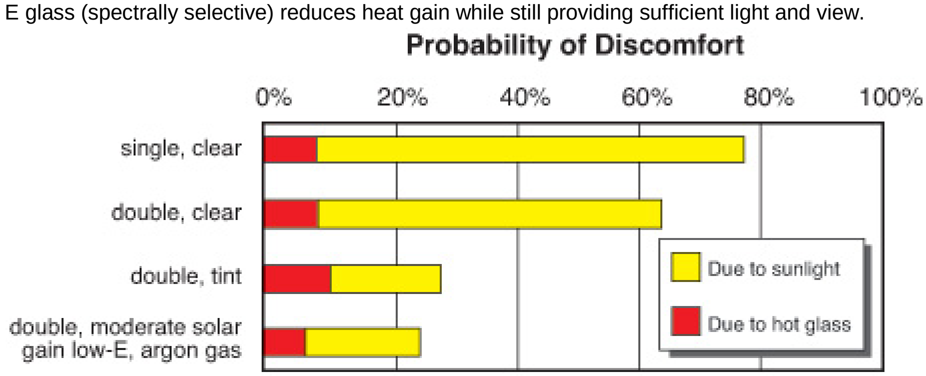


Performance of Double-Glazed Low-Solar-Gain Low-E Glass (Spectrally Selective) and Argon Gas Fill

It is well documented that buildings (which account for over 70% of the electricity used in the United States) have the greatest potential for reducing both energy use and particularly peak electricity use. Peak electricity use is driven by air conditioning load, which is, in large part, driven by summer solar gain. Lower SHGC windows will translate into substantial energy cost savings for building owners and a reduced need for utilities to build additional peak generating plants. For example, based on US DOE's EnergyPlus office reference buildings and an assumption of 30% fenestration area, we estimate a net energy savings (heating, cooling and hot water) for this proposed reduction in maximum SHGC to 0.25 ranging between 2% and 5% depending on the climate zone.

In addition, lower SHGCs will result in smaller cooling equipment for such buildings, easily offsetting any cost increase, thereby reducing first cost as well. Reducing SHGC will provide savings to all consumers, and not just the owners or operators of buildings. Lower SHGCs also produce increased summer comfort, as also illustrated by the EWC on its website. According to EWC:

> In summer, strong direct sunlight strikes people and interior surfaces, creating overheating and discomfort. Windows with low solar heat gain coefficients will reduce the solar radiation coming through the glass and associated discomfort. Low solar heat gain low-E glass (spectrally selective) reduces heat gain while still providing sufficient light and view.



Source: Lawrence Berkeley National Laboratory (Lyons and Arasteh).

For all of these reasons, reducing the SHGC prescriptive requirement to 0.25 in climate zones 4 – 6 is justified in order to reduce energy use and electrical peak demand in commercial buildings.

Cost Impact: The code change proposal will not increase the cost of construction.

CE145-13

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

C402.3T #1-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE146 – 13
C402.3.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than ~~10,000~~ 2,000 square feet (~~929~~ 185 m^2), directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent with a skylight VT of at least 0.40; or

2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation 4-1.

$$\text{Skylight Effective Aperature} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}}$$

(Equation 4-1)

where:

Skylight area = Total fenestration area of skylights.
Skylight VT = Area weighted average visible transmittance of skylights.
WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.
Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

Reason: The use of skylights for daylighting has been shown to be cost effective, and the major portion of the cost is the skylights. This proposal reduces the area threshold for daylighting control requirements in skylit areas to 2,000 square feet. Because the skylight cost is proportional to area, having a high threshold for the skylight daylighting requirement only makes sense if the individual zone control cost is high. The code change proposal reflects the fact that in new construction, the zone control cost is relatively low and a smaller threshold is justified.

A single skylight in a space at the limiting ceiling height of 15 feet creates a daylight area slightly larger than 1,000 ft2. Since the requirement is that half the qualifying area receiving skylights and daylight control, then a threshold of 2000 square feet for this requirement is logical if the cost of the skylights can be shown to be cost effective.

An analysis conducted in conjunction with this proposal shows that installing this skylight and the associated daylighting controls within such a space is cost effective. This reduced threshold is mainly due to the reduction in cost of daylighting controls and the reduction of thermal losses and gains through skylights due to improved envelope requirements. The code change proposal reflects the fact that in new construction, the zone control cost is relatively low and a smaller threshold is justified. The lower threshold will add daylighting in smaller, high ceiling spaces that were previously not required to have skylights.

There is a cost increase associated with this proposed change because skylights and controls would be required in areas they are not required under the current code. A cost-effectiveness analysis of the savings resulting from skylight daylighting control shows that such control and skylights are cost effective for a daylit space of 1,000 ft2. In the cost effectiveness analysis the additional skylights and controls had a simple payback ranging from 12.0 to 17.1 years. Based on a skylight life of 40 years, a discounted cost effective payback threshold is 21.8 years. The simple paybacks for all of the additional skylights and controls required under this proposal are well below this cost effective threshold.

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

CE146-13

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

C402.3.2 #1-EC-WILLIAMS rev.doc

CE147 – 13
C402.3.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than ~~10,000~~ 2,500 square feet ~~(929 m^2)~~, directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, playing area, gymnasium seating, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, library reading and stack areas, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent with a skylight VT of at least 0.40; or
2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation 4-1.

$$\text{Skylight Effective Aperature} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}} \quad \text{(Equation 4-1)}$$

where:

Skylight area = Total fenestration area of skylights.
Skylight VT = Area weighted average visible transmittance of skylights.
WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.
Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8
2. ~~Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2)~~
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.
5. Spaces where 90 percent of the skylight area is shaded on June 21 in the Northern Hemisphere (December 21 in the Southern Hemisphere) at noon by permanent architectural features of the building.
6. Spaces where the total area minus the daylight zones area adjacent to vertical fenestration is less than 2,500 square feet, and where the lighting is automatically controlled in accordance with Section C405.2.2.3.2.

Reason: The current toplighting requirements in the IECC are based on ANSI/ASHRAE/IES Standard 90.1-2010. Additional revisions are being made to 90.1 in addendum bv. This proposal will make the next version of the IECC consistent with 90.1-2013 for toplighting requirements.

Cost Impact: The code change proposal will increase the cost of construction for spaces between 2,500 ft^2 and 10,000 ft.

CE147-13

Public Hearing:	Committee:	AS	AM	D

Assembly: ASF AMF DF

C402.3.2 #1-EC-FERGUSON.doc

CE148 – 13
C402.3.2

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than ~~10,000~~ 2,500 square feet (~~929~~ 232 m^2), directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent with a skylight VT of at least 0.40; or
2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation 4-1.

$$\text{Skylight Effective Aperature} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}}$$

(Equation 4-1)

where:

Skylight area	=	Total fenestration area of skylights.
Skylight VT	=	Area weighted average visible transmittance of skylights.
WF	=	Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.
Light well depth	=	Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8.
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under the rooftop monitors is greater than 50 percent of the enclosed space floor area.
5. Spaces where the total area minus the area of *daylight zones adjacent to vertical fenestration* is less than 2,500 square feet (929 232 m^2), and where the lighting is controlled according to Section C405.2.2.3.2.

Reason: Separate analyses for ASHRAE 90.1 and California Title 24 have shown toplighting of larger open spaces to provide very cost effective energy savings, and that the size threshold may be significantly reduced from the current 10,000 ft2. 2008 Title 24 uses an 8,000 ft2 threshold, and will use 5,000 ft2 in the 2013 standard. ASHRAE 90.1-2010 has already been at 5,000 ft2, and following a new cost effectiveness analysis by Pacific Northwest National Laboratory, is now lowering it further to 2,500 ft2. At the time this proposal was submitted in Dec 2012, addendum "bv" received no negative comments on the threshold, and was moving forward to the ASHRAE and IES boards for final publication. Some had expressed concern about smaller retail spaces that might be triggered by the 2,500 ft2 threshold, but it was noted that these types of retail spaces rarely have ceiling heights over 15 ft, and would therefore be exempt. (Also, toplighting is ideal for the retail spaces that do have taller ceiling heights over 15 ft, such as grocery stores and larger retail.) As such, this proposal lowers the threshold and also adds an exception to be consistent with ASHRAE 90.1 addendum "bv".

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

CE148-13

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

C402.3.2-EC-CULP.doc

CE149 – 13
C402.3.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.2 Minimum skylight ~~fenestration~~ area. In an enclosed space greater than 10,000 square feet (929 m^2) in floor area directly under a roof with ~~a~~ not less than 75 percent of ceiling area with heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, non-refrigerated warehouse, retail store, distribution/sorting area, transportation depot, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide ~~a minimum skylight area to daylight zone under skylights of~~ either

1. A minimum skylight area to daylight zone under skylights of not less than 3 percent ~~with a skylight~~ where all skylights have a VT of at least 0.40 when tested in accordance with NFRC 202, or

2. A ~~provide~~ minimum skylight effective aperture of at least 1 percent as determined in accordance with Equation 4-1.

$$\text{Skylight Effective Aperature} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}}$$

(Equation 4-1)

where:

Skylight area = Total fenestration area of skylights.

Skylight VT = Area weighted average visible transmittance of skylights.

WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.

Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8.
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

Reason: This proposal clarifies the language pertaining to requiring skylights in roofs covering areas greater than 10,000 ft^2. The objective of this proposal is to clarify the code to foster implementation and compliance verification.

By definition skylights are fenestration such that the use of the term fenestration with skylights is redundant. The intent is to address ceilings with variable heights and the proposed revision does that by indicating the requirement applies when more than 75% of ceiling area is above 15 feet. Some of the subject spaces referenced are not technically spaces or areas so the language has been enhanced to convey the intent. Simplification is achieved by making items 1 and 2 parallel construction with reference to the charging section. While VT is defined, there is no referenced test method. NFRC 202 provides a uniform test method by which VT can be objectively determined and should be referenced to enhance uniformity of application and implementation of and compliance verification with the code.

Cost Impact: The code change proposal will not increase the cost of construction. There is no cost impact associated with this proposed change because the current code requires daylighting control.

CE149-13

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

C402.3.2 #2-EC-WILLIAMS.doc

CE150 – 13
C402.3.2

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than 10,000 square feet (929 m^2) directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and fenestration shall be configured so that either: ~~and shall provide a minimum skylight area to daylight zone under skylights of either~~:

1. The skylight area divided by the daylight zone area is not less than 3 percent with a skylight VT of at least 0.40; or
2. Provide a minimum skylight effective aperture of at least ~~1~~ 1.2 percent determined in accordance with Equation 4-1.

$$\text{Skylight Effective Aperture} = \frac{\cancel{0.85\ x}\ \text{Skylight Area x Skylight VT} \cancel{\text{ x WF}}}{\text{Daylight zone under skylight}}$$

(Equation 4-1)

where:

Skylight area =	Total fenestration area of skylights.
Skylight VT =	Area weighted average visible transmittance of skylights.
~~WF =~~	~~Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.~~
~~Light well depth =~~	~~Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.~~

Exception: Skylights ~~above daylight zones of enclosed spaces~~ are not required in:

1. Buildings in climate zones 6 through 8.
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

Reason: The well factor calculation adds complexity without significantly improving the accuracy of the analysis. The minimum skylight effective aperture is increased from 1.0 percent to 1.2 percent so that similar results are obtained regardless of whether option 1 or option 2 is followed.

The language in the exception in confusing, and the proposed change is editorial.

Cost Impact: The code change proposal will not increase the cost of construction.

CE150-13

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

CE151 – 13
C202 (NEW), C402.3.2.1

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C402.3.2.1 Lighting controls in daylight zones under skylights. All lighting in the daylight zone shall be controlled by multilevel lighting controls that comply with Section C405.2.2.3.3.

> **Exception:** Skylights above daylight zones of enclosed spaces are not required in:
>
> 1. Buildings in Climate Zones 6 through 8
> 2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
> 3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
> 4. Spaces where the daylight zone under *roof~~top~~ monitors* is greater than 50 percent of the enclosed space floor area.

Revise definitions as follows:

SECTION C202
GENERAL DEFINITIONS

ROOF MONITOR. That part of a *building* that projects above the plane of the *roof* and whose walls contain *vertical fenestration* for lighting the interior.

DAYLIGHT ZONE.

1. **Under skylights.** The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor-to-ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.
2. **Adjacent to vertical fenestration.** The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the daylight *zone* depth is assumed to extend into the space a distance of 15 feet (4572 mm) or to the nearest ceiling height opaque partition, whichever is less. The daylight *zone* width is assumed to be the width of the window plus 2 feet (610 mm) on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.
3. **Under roof monitors.** The combined area under each *roof monitor* without double counting overlapping areas from multiple roof monitors. It is the product of the daylight area width under *roof monitors* and the daylight area depth under *roof monitors*. The daylight area width under *roof monitors* is the width of the *vertical fenestration* above the ceiling level plus on each side, the smallest of: 2 feet (0.6m), or the distance to any 60 inch (1525 mm) or higher vertical obstruction or the distance to the edge of any primary sidelighted area. The daylight area depth under roof monitors is the smallest of the following horizontal distances inward from the bottom edge of the *vertical fenestration*, the monitor sill height, (the vertical distance from the floor to the bottom edge of the monitor glazing), or the distance to the edge of any primary sidelighted area or, the distance to the front face of any vertical obstruction where any part of the obstruction is farther away than the difference between the height of the obstruction and the monitor sill height.

Reason: The term "rooftop monitor" is currently used in the IECC, but it's not defined. There is some ambiguity about the term and the definition. This proposal makes the terminology and definition consistent with ANSI/ASHRAE/IES Standard 90.1 by using the term roof monitor, and adding a definition for the term. It also adds a definition for the daylight zone under a roof monitor which is used in daylighting proposals.

Cost Impact: The code change proposal will not increase the cost of construction.

CE151-13

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

C402.3.2 #2-EC-FERGUSON.doc

CE152 – 13
C402.3.3 (NEW)

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Add new text as follows:

C402.3.3 Daylight zones. In *buildings* not greater than two stories above grade plane, not less than 10 percent of the net floor area shall be located within a *daylight zone*. In *buildings* three or more stories above grade plane, not less than 5 percent of the net floor area shall be located within a *daylight zone.*

Exception: Daylighting in accordance with this section is not required in the following spaces:

1. Auditoriums, places of religious worship, theaters, museums, mercantile occupancies with less than 10,000 square feet of net floor area, and refrigerated warehouses.
2. Existing buildings undergoing *alteration*, *repair*, relocation, or a change of occupancy.
3. *Buildings* where the total daylight potential (TDP) calculated in accordance with Section 808.3 of the *International Green Construction Code* is less than 0.5.

Reason: This proposal would require a minimum daylight area similar in concept to the 2012 International Green Construction Code, but at much less aggressive level (only 1/5 of the IgCC) and with a simplified approach. For comparison, the IgCC requires 50% of the net floor area to be in daylight zones for 1-2 story buildings, and 25% for 3+ story buildings. On the other hand, this proposal is meant to only be a simple base level requirement to ensure that building designers address daylighting and glazing layout, while being easy enough to provide flexibility for different space and building types, and not require any gross changes in building geometry. Exceptions are included for spaces where daylighting would interfere with the function of the space, provide little benefit, or not be feasible.

Cost Impact: This proposal will not increase the cost of construction for most buildings and will help improve layout and use of glazing that would have been installed anyway, but this will increase the cost of construction in some buildings where there would have been insufficient fenestration and daylighting.

CE152-13

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

C402.3.3 (NEW)-EC-CULP.doc

CE153 – 13
C402.3.2.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.2.2 Haze factor. Skylights in office, storage, automotive, service, manufacturing, non-refrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing materials or diffuser with a ~~measured~~ haze factor greater than 90 percent when tested in accordance with Procedure A of ASTM D 1003.

> **Exception:** Skylights ~~designed~~ installed to exclude direct sunlight entering the occupied space by use of fixed or automated baffles, or the geometry of skylight and light well ~~need not comply with Section C402.3.2.2~~.

Reason: This proposal clarifies the testing requirements for fenestration haze factor to reference Procedure A of ASTM D 1003 or other ASTM standards as applicable.

The requirement for testing in the code eliminates the need to use the term “measured,” and could provide additional confusion should a user of the code interpret that as allowing post-installation measurement of haze factor in accordance with the standard. ASTM D 1003 has multiple procedures. Procedure A (hazemeter) test values are normally slightly higher and less variable than Procedure B (spectrophotometer) test values. Where the code indicates a singular criterion (90%) a singular test procedure should be specifically referenced. If there are two test procedures that yield different results for the same metric then the code should provide a separate criterion for each procedure (e.g. 90% when tested per procedure A and a TBD equivalent percentage when tested per procedure B). Also replacing “designed” with “installed ” provides clarification as a skylight can be “designed” in the factory where the installation conditions in the exception may not be known. Those conditions are related to the installation of the skylight within the building and are more appropriately referenced in the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE153-13

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

C402.3.2.2-EC-WILLIAMS.doc

CE154 – 13
C402.3.2.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.3.2.2 Haze factor. Skylights in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store, and distribution/sorting area spaces shall have a glazing material or diffuser with a measured haze factor greater than 90 percent when tested in accordance with <u>the procedures contained in</u> ASTM D 1003.

> **Exception:** Skylights designed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles, or the geometry of skylight and light well need not comply with Section C402.3.2.2.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

ASTM D 1003 has the title of “Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.” However the standard actually contains test methods and procedures for all transparent materials and isn’t limited in application to plastics. As it is up to ASTM to name their standard and it can’t be changed in the ICC process, this proposal is intended to try to clarify that the standard is used for the procedures, and not limited to the material contained in the title.

Cost Impact: This code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE154-13

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

C402.3.2.2-EC-THOMPSON-SEHPCAC.doc

CE155 – 13
C402.3.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.3 Maximum U-factor and SHGC. ~~For vertical fenestration, the~~ The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.3~~, based on the window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3~~.

The window projection factor shall be determined in accordance with Equation 4-2.

$PF = A/B$ **(Equation 4-2)**

where:

PF= Projection factor (decimal).
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

Reason: This proposal clarifies the provisions in the code related to maximum U-factor and SHGC, to increase simplicity of the code.

The opening section (parent) need only state the scope and criteria and then when consulting Table C402.3 as required the application of the provisions as to which type of fenestration (vertical or skylight) become obvious. The relevance of text beyond the first paragraph of Section C402.3.3 does not become apparent until after Table C402.3.3.1 and should be relocated after that table where is relates to the PF term used in that table.

Cost Impact: The code change proposal will not increase the cost of construction.

CE155-13

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

C402.3.3-EC-WILLIAMS.doc

CE156 – 13

C402.3.3, C402.3.3.1

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.3.3 Maximum U-factor and SHGC. For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3, based on the climate zone, type of vertical fenestration and, for SHGC, adjusted where necessary for window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3 by climate zone.

~~The window projection factor shall be determined in accordance with Equation C4-2.~~

~~PF = A/B~~ ~~**(Equation C4-2)**~~

~~where:~~

~~PF = Projection factor (decimal).~~

~~A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.~~

~~B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.~~

~~Where different windows or glass doors have different PF values, they shall each be evaluated separately.~~

C402.3.3.1 SHGC adjustment. Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.2, the ~~required~~ maximum SHGC from Table C402.3 shall be adjusted by multiplying the required maximum SHGC by the adjustment multiplier specified in Table C402.3.3.1 corresponding with the ~~orientation of the fenestration product and the~~ projection factor for each fenestration product.

TABLE C402.3.3.1
SHGC ADJUSTMENT FOR PROJECTION FACTOR ~~MULTIPLIERS~~

PROJECTION FACTOR	~~ORIENTED WITHIN 45 DEGREES OF TRUE NORTH~~ SHGC ADJUSTMENT MULTIPLIER	~~ALL OTHER ORIENTATION~~
$0.2 \le PF < 0.5$	~~1.1~~ 1.2	~~1.2~~
$PF \ge 0.5$	~~1.2~~ 1.6	~~1.6~~

The projection factor for each vertical fenestration product shall be determined in accordance with Equation C4-2.

PF = A/B **(Equation C4-2)**

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different PF values, they shall each be evaluated separately.

Reason: The purpose of this proposal is to simplify and improve the code in how it addresses the prescriptive U-factor and SHGC requirements for fenestration and the effects of projection factor by:

- cleaning up, clarifying and making the language more specific;
- moving the projection factor methodology and equation to a more appropriate place in the IECC (in the section that establishes an adjustment for projection factor);
- eliminating the need to calculate the projection factor for each window for buildings with little (<0.20) or no projection factor and which do not qualify for an SHGC adjustment; and
- applying a uniform projection factor multiplier to SHGC requirements, regardless of the orientation of the fenestration.

The current IECC applies a different SHGC multiplier to fenestration oriented within 45 degrees of true north as opposed to all other fenestration. While the multipliers yield mathematically correct results based on the current approach in *ASHRAE 90.1*, some code users have expressed concern that windows facing north should not be required to meet a lower SHGC number than windows facing other directions. This proposal eliminates this concern, while simplifying the code, by moving to a single multiplier for all orientations. At the same time, by retaining the multiplier approach, this proposal allows for an automatic adjustment in the event the underlying SHGC values are modified in the future.

Cost Impact: The code change proposal will not increase the cost of construction.

CE156-13

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

C402.3.3-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE157 – 13
C402.3.3.1, Table C402.3.3.1, C402.3.3.2 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

~~**C402.3.3.1 SHGC adjustment.** Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.2, the required maximum SHGC from Table C402.3 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.3.3.1 corresponding with the orientation of the fenestration product and the projection factor~~

C402.3.3.1 SHGC of vertical fenestration. Vertical *fenestration* shall have an *SHGC* not greater than that specified in Table C402.3. *Dynamic glazing* shall be considered separately from other vertical *fenestration*, and area weighted averaging with other vertical *fenestration* that is not *dynamic glazing* shall not be permitted.

Exceptions. Vertical *fenestration* that complies with all of the following:

1. The *fenestration* located on the first floor above grade The first floor is no greater than 20 feet in height above grade,
2. The *fenestration* has a permanent projection factor with a PF greater than 0.5, and
3. The *fenestration* is no greater than 75 percent of the gross wall area.

C402.3.3.1.1 SHGC reduction for permanent shading. The required SHGC shall be reduced by using the multipliers in Table 402.3.3.1 if the vertical *fenestration* is shaded by opaque permanent projections in accordance with one of the following methods:

1. Open louvers provided that no sun penetrates the louvers during the peak sun angle on June 21 in the Northern Hemisphere (December 21 in the Southern Hemisphere).
2. The PF used in the SHGC calculation shall be reduced by multiplying it by a Os, determined by Equation 4-x, if permanent projections shade vertical *fenestration*.

$$Os = (Ai \times Oi) + (Af \times Of) \qquad \textbf{Equation 4-x}$$

Where

Os = percent opacity of the shading device
Ai = percent of the area of the shading device that is a partially opaque infill
Oi = percent opacity of the infill—for glass *Oi* = (100% -*Ts*), where *Ts* is the solar transmittance as determined in accordance with NFRC 300; for perforated or decorative metal panels
Oi = percentage of solid material
Af = percent of the area of the shading device that represents the framing members
Of = percent opacity of the framing members; Where solid, Of= 100%

~~**TABLE C402.3.3.1**~~
~~**SHGC ADJUSTMENT MULTIPLIERS**~~

~~PROJECTION FACTOR~~	~~ORIENTED WITHIN 45 DEGREES OF TRUE NORTH~~	~~ALL OTHER ORIENTATION~~
~~0.2 ≤ PF < 0.5~~	~~1.1~~	~~1.2~~

~~PF ≥ 0.5~~	~~1.2~~	~~1.6~~

TABLE 402.3.3.1
SHGC Multipliers for Permanent Projections

Projection Factor	SHGC Multiplier (All Other Orientations)	SHGC Multiplier (North-Oriented)
0–0.10	1.00	1.00
>0.10–0.20	0.91	0.95
>0.20–0.30	0.82	0.91
>0.30–0.40	0.74	0.87
>0.40–0.50	0.67	0.84
>0.50–0.60	0.61	0.81
>0.60–0.70	0.56	0.78
>0.70–0.80	0.51	0.76
>0.80–0.90	0.47	0.75
>0.90–1.00	0.44	0.73

C402.3.3.2 Fenestration orientation. The vertical fenestration shall comply with either Equation 4-y or 4-z

$A_W \le (A_T)/4$ and $A_E \le (A_T)/4$ **Equation 4-y**

$A_W \times SHGC_W \le (A_T \times SHGC_C)/4$ and $A_E \times SHGC_E \le (A_T \times SHGC_C)/4$ **Equation 4-z**

Where

A_w = west oriented vertical *fenestration area* (oriented within 45 degrees of true west to the south and within 22.5 degrees of true west to the north in the northern hemisphere; oriented within 45 degrees of true west to the north and within 22.5 degrees of true west to the south in the southern hemisphere)
A_e = east oriented vertical *fenestration area* (oriented within 45 degrees of true east to the south and within 22.5 degrees of true east to the north in the northern hemisphere; oriented within 45 degrees of true east to the north and within 22.5 degrees of true east to the south in the southern hemisphere)
A_T = total vertical *fenestration area*
$SHGC_C$ = the *SHGC* criteria in Table C402.3 for each climate zone
$SHGC_E$ = the *SHGC* for east-oriented *fenestration* that complies with Section C402.3.3.1
$SHGC_W$ = the *SHGC* for west-oriented *fenestration* that complies with Section C402.3.3.1

Reason: This revision to the building/fenestration orientation requirements provides more specific requirements for east and west facing fenestration while also providing more flexibility for complying. Analyses indicate that east and west facing fenestration increases building energy consumption compared to north and south facing glazing in all climates. The criteria can be met by limiting fenestration area, changing the fenestration SHGC, or orienting the building so that the long axis is in the east-west direction. A number of exceptions are provided. New exceptions include one for buildings with less than 20% fenestration on the east and west facades and one for buildings in Climate Zone 8. The definitions for the areas east and west oriented fenestration have also been further refined. This is consistent with addendum bw to ANSI/ASHRAE/IES Standard 90.1

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

CE157-13

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

C402.3.3.1-EC-FERGUSON.doc

CE158 – 13
C402.3.3.2

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Delete without substitution as follows:

~~**C402.3.3.2 Increased vertical fenestration SHGC.** In Climate Zones 1, 2 and 3, vertical fenestration entirely located not less than 6 feet (1729 mm) above the finished floor shall be permitted a maximum SHGC of 0.40.~~

Reason: The purpose of the proposed code change is to eliminate an exception to the fenestration SHGC requirement because it does not produce equivalent energy savings. In climate zones 1-3, low-SHGC fenestration is crucial for lowering energy use and peak electric demand. If there are to be any exceptions from this requirement, the exceptions should result in energy savings that will meet or exceed the savings that would have resulted from using 0.25 SHGC windows.

The current language does not meet this hurdle. It carves out an exception for fenestration located more than 6 feet above the finished floor. However, the exception does not require higher-VT fenestration, or clarify whether the windows must be part of a daylight area, or require the installation of automatic daylighting controls that possibly could offset at least some of the resulting increase in energy use. The language simply increases the maximum SHGC allowed by 60% with no requirement for any offset. Solar heat gain and the associated peak electricity use of commercial buildings are too important to carve out unnecessary exemptions like C402.3.3.2.

Presumably this exception was created to help with daylighting on the theory that a higher SHGC was necessary for more daylighting. We too are in favor of improving daylighting. However, we do not believe it is necessary to sacrifice solar heat gain reduction to obtain adequate visible light. Substantial VT can be achieved while still meeting the SHGC requirements. We have submitted a companion proposal for a minimum VT, which will do just that.

Moreover, eliminating this exception will also improve the clarity and usability of the code because it is an extremely specific exception that only adds unnecessary complexity to the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE158-13

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

C402.3.3.2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE159 – 13
C402.3.3.5

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Bill Prindle, Energy Efficient Codes Coalition; ; Harry Misuriello, American Council for an Energy-Efficient Economy; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.3.3.5 Dynamic Glazing. For compliance with Section C402.3.3, the SHGC for dynamic glazing products shall be determined using the ~~manufacturer's~~ average of the product's lowest~~-rated~~ and highest SHGC value from the product's label, and the VT~~/SHGC ratio~~ shall be determined ~~using the maximum VT and maximum SHGC~~ using the average of the product's lowest and highest VT value from the product's label. Dynamic glazing shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

Reason: The purpose of the proposed code change is to correct how the SHGC and VT are determined for dynamic glazing to reflect that there is no guarantee that dynamic glazing will be operated to minimize either SHGC or VT. Current dynamic glazing assumptions in the IECC are physically impossible and are inconsistent with fenestration product labels. Dynamic glazing products are labeled based on both the "on/open" setting and the "off/closed" setting (there are also variable products with ranges of performance). In one of these settings the product blocks solar heat gain, thereby also reducing visible light. In the other setting, the product blocks less solar heat gain and allows more visible light to pass through the glass These two conditions do not overlap – either the product is "on" or "off" at any given time during the day. The current definition would suggest that windows are optimally operated to block the maximum solar heat gain throughout the day, which would clearly not allow for visible light to be at the maximum during the day. However, the current language in Section C402.3.3.5 awards the code user the best-case efficiency for SHGC, as well as the best-case VT level, even though the two conditions cannot take place at the same time.

This proposal corrects the inconsistency in the code by averaging the lowest and highest rated values for SHGC and VT, reflecting the fact that there is no guarantee whether the product will be maximizing SHGC or maximizing VT. It does not make sense to assume that the product would be "on" for 24 hours for purposes of calculating SHGC, but "off" for 24 hours for purposes of calculating the VT. This proposal takes the average of the two sets of "best case" assumptions.

Cost Impact: The code change proposal will not increase the cost of construction.

CE159-13

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

C402.3.3.5-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE160 – 13
C402.3.3.5, R402.3.3 (NEW) (IRC N1102.3.3 (NEW))

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.3.3.5 Dynamic glazing. For compliance with Section C402.3.3, the SHGC for dynamic glazing shall be determined using the manufacturer's lowest-rated SHGC, and the VT/SHGC ratio shall be determined using the maximum VT and maximum SHGC. <u>Where the range of values that dynamic glazing can achieve includes the required value for SHGC, U-factor, VT, or VT/SHGC for the glazing and the dynamic glazing is automatically controlled, the dynamic glazing shall be deemed to meet that requirement.</u> Dynamic glazing shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

<u>**R402.3.3 (N1102.3.3) Dynamic glazing.** Where the range of values that dynamic glazing can achieve includes the required value for SHGC or U-factor for the glazing and the dynamic glazing is automatically controlled, the dynamic glazing shall be deemed to meet that requirement.</u>

Reason: Dynamic glazing has the potential to become a variable opening that changes quickly, as if we could switch out the glazing in a very short time. Dynamic glazing which can switch it characteristics to respond to the situation could be valuable, a variable characteristic is likely to be much more valuable than any particular single value. The biggest concern in the code world should be to get out of its way and let it behave intelligently.

Dynamic glazing costs significantly more than regular glazing. It will not be purchased simply to get around the energy code. Another option, not presented above, would be simply to not regulate the characteristics that can be automatically controlled. The code could presume that the buyer of such a product is very motivated to may it work well and not over regulate the product.

In any case the code should not get in the way of a product that can change literally as fast as the weather.

Cost Impact: The code change proposal will not increase the cost of construction.

CE160-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C402.3.3.5-EC-CONNER.doc

CE161 – 13
C402.3.3.5, R402.3.2 (IRC N1102.3.2)

Proponent: Dr. Helen Sanders, SAGE Electrochromics Inc. (helen.sanders@sageglass.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.3.3.5 Dynamic glazing. ~~For compliance with Section C402.3.3, the SHGC for *dynamic glazing* shall be determined using the manufacturer's lowest-rated SHGC, and the VT/SHGC ratio shall be determined using the maximum VT and maximum SHGC.~~ *Dynamic glazing* shall be permitted to satisfy the SHGC and VT requirements of Table C402.3 and Section C402.3.1.1 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 3, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not *dynamic glazing* shall not be permitted.

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R402.3.2 (N1102.3.2) Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50-percent glazed shall be permitted to satisfy the SHGC requirements.

Dynamic glazing shall be permitted to satisfy the SHGC requirements of Table R402.3.3 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 3, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

Reason: (Part I) Last cycle, the commercial IECC clarified how to deal with code compliance for dynamic glazing, and dynamic glazing is also now addressed in the IgCC, ASHRAE 90.1, ASHRAE 189.1, and the new 2013 California Title 24 standards. This was important in that dynamic glazing offers the unique ability to reversibly change properties such as SHGC and VT to optimize energy performance, daylighting, and glare based on changing situations during the day, and over different seasons. As such, dynamic glazing represents a key technology on the route to zero energy buildings, and has been strongly supported by the U.S. Department of Energy, Lawrence Berkeley National Laboratory, and the National Renewable Energy Laboratory.

However, to provide additional assurances that the dynamic glazing delivers the maximum energy savings, this proposal strengthens the requirement by only allowing compliance if the dynamic glazing has a certain dynamic range (ratio of the high to low SHGC greater than 3) and is automatically controlled in multiple steps. The minimum dynamic range prevents a loophole for products claiming dynamic properties that do not really have a significant energy impact. Also, with a minimum SHGC dynamic ratio of 3, the current language about using the lowest rated SHGC for compliance is no longer needed … the highest SHGC in any double glazing is perhaps 0.60, so the lowest SHGC would have to be < 0.20, which is already lower than the lowest 0.25 SHGC requirement. Furthermore, although the dynamic range is specified as a SHGC ratio, this also ensures a good dynamic range for VT, which will be higher than the SHGC ratio. (Typical products commonly have SHGC range from <0.10 to >0.40, and VT range from <0.04 to >0.50.)

Finally, the dynamic glazing must be properly controlled in order to optimize energy performance. Dynamic glazing is almost always already sold as a system integrated with automatic controls, but this proposal clarifies that the dynamic glazing must be automatically controlled in multiple steps, and not rely on manual adjustment by occupants.

(Part II) Dynamic glazing is currently defined and addressed in the commercial IECC, as well as the IgCC, ASHRAE 90.1, ASHRAE 189.1, and the new 2013 California Title 24 standards. However, the residential IECC does not currently address how to deal with compliance of dynamic glazing. Dynamic glazing is unique in that it has the ability to reversibly change properties such as SHGC and VT. This allows the glazing to be controlled optimize energy performance, daylighting, and glare based on changing situations during the day, and over different seasons. For example, unlike traditional glazing with fixed properties, dynamic glazing can be operated in a lower SHGC state during summer to reduce cooling loads, and a higher SHGC state during winter to reduce heating loads.

As such, dynamic glazing represents a key technology on the route to zero energy buildings, and has been strongly supported by the U.S. Department of Energy, Lawrence Berkeley National Laboratory, and the National Renewable Energy Laboratory. Dynamic glazing has been available on the market for 10 years now, and manufacturing expansions have come on line in 2012 to provide larger pane sizes at higher volumes and lower prices to allow broader application. Not only should its use be encouraged, but barriers to its use must be removed. Specifically, the NFRC label for dynamic glazing which has been in place for a number of years, lists two values for SHGC, representing the range over which the SHGC varies. It is not clear how this label should be used to determine compliance with maximum or minimum SHGC requirements, and direction must be given to aid enforcement by the building code official.

Because of the ability of dynamic glazing to optimize solar gain and energy efficiency, the commercial IECC already allows compliance with SHGC requirements by simply saying to use the lower labeled SHGC value, and to treat dynamic glazing separately from other fenestration in the building (no mixing in area-weighted averages). To provide additional assurances of proper performance, this proposal provides a stronger requirement by only allowing compliance if the dynamic glazing has a certain dynamic range (ratio of the high to low SHGC greater than 3) and is automatically controlled in multiple steps. First, the minimum dynamic range prevents a loophole for products claiming dynamic properties that do not really have a significant energy impact. The minimum SHGC dynamic ratio of 3 will also more than ensure compliance with the lowest rated SHGC … the highest SHGC in any double glazing is perhaps 0.60, so the lowest SHGC would have to be < 0.20, which is already lower than the lowest 0.25 SHGC requirement. (In practice, typical products commonly have SHGC range from <0.10 to 0.40.) Second, the dynamic glazing must be properly controlled in order to optimize energy performance. Automatic controls are especially important in a residential home or apartment, where the occupant may not be home to manually adjust the glazing. A separate proposal is also being submitted to the commercial IECC to strengthen those requirements in a similar manner.

References:

1. "Window Systems for High-Performance Buildings" by Carmody, Selkowitz, Lee, Arasteh, Willmert, 2004, pages 94-100.
2. Lawrence Berkeley National Laboratory – Paper 50502
   "High Performance Commercial Building Facades" by Lee, Selkowitz, Bazjanac, Inkarojrit, and Kohler, 2002. See especially p. 28. http://windows.lbl.gov/comm_perf/Electrochromic/refs/LBNL-50502.pdf
3. Lawrence Berkeley National Laboratory – Paper 54924
   "Daylighting control performance of a thin-film ceramic electrochromic window: field study results" by Lee, DiBartolomeo, Selkowitz, 2005. http://windows.lbl.gov/comm_perf/Electrochromic/refs/LBNL-54924.pdf

Cost Impact: The code change proposal will not increase the cost of construction. The large majority of dynamic glazing is already sold with automatic control systems.

CE161-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

PART I AND II TEMPLATE.doc

CE162 – 13
C402.3.3.5

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, P.C

Revise as follows:

C402.3.3.5 Dynamic Glazing. For compliance with Section C402.3.3, the SHGC for dynamic glazing products shall be determined using the ~~manufacturer's~~ lowest~~-rated~~ SHGC value on the product label, and the VT~~/SHGC ratio~~ shall be determined using the ~~maximum~~ VT ~~and maximum~~ value on the product label that corresponds with the product's lowest SHGC. Dynamic glazing shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

Reason: The purpose of the proposed code change is to modify how VT is determined for dynamic glazing. The current dynamic glazing assumptions in the IECC are physically impossible and are inconsistent with fenestration product values. Dynamic glazing products are typically labeled at NFRC based on both the "on/open" setting and the "off/closed" setting (there are also variable products with ranges of performance). In one of these settings the product blocks solar heat gain, thereby also reducing visible light. In the other setting, the product blocks less solar heat gain and allows more visible light to pass through the glass These two conditions do not overlap – either the product is "on" or "off" at any given time during the day. The current definition would suggest that windows are optimally operated to block the maximum solar heat gain throughout the day, which would clearly not allow for visible light to be at the maximum during the day. However, the current language in Section C402.3.3.5 awards the dynamic glazing user the best-case efficiency for SHGC, as well as the best-case VT level, even though the two conditions cannot take place at the same time.

This proposal clarifies that the efficiency rating for dynamic glazing will be based on the lowest SHGC on the label as per the current code language, and then requires using the VT rating that corresponds with that same setting. In other words, the above amendment gives the product the best possible rating (from an SHGC perspective) that is also consistent with its label.

Cost Impact: The code change proposal will not increase the cost of construction.

CE162-13

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

C402.3.3.5-EC-STONE.doc

CE163 – 13
C402.3.4

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.4 Area weighted U-factor. An area-weighted average U-factor shall be permitted to satisfy the U-factor requirement~~s~~ ~~for each fenestration product category listed~~ in Table C402.3 separately for fixed fenestration, operable fenestration and entrance doors. Individual fenestration products from different fenestration product categories listed in Table C402.3 shall not be combined in calculating area-weighted U-factor.

Reason: This proposal clarifies the provisions in the code related to area weighted U-factor, to simplify the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE163-13

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

C402.3.4-EC-WILLIAMS.doc

CE164 – 13
C402.4, C402.4.1.2, C402.4.1.2.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4 Air leakage (Mandatory). The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8. Alternatively the building thermal envelope shall be permitted to be tested in accordance with ASTM E779 at a pressure differential of 0.3 inches water gauge, or an equivalent method approved by the code official, and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope does not exceed 0.40 cfm/ft^2. Where compliance is based on such testing the building shall also comply with Sections C402.4.5, 402.4.6 and 402.4.7.

C402.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque portions of the building thermal envelope shall comply with Section C402.4.1.2.1, or C402.4.1.2.2. ~~or C402.4.1.2.3~~.

~~**C402.4.1.2.3 Building test.** The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m^2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official.~~

Reason: This proposal clarifies the language pertaining to the sealing of penetrations in the building thermal envelope associated with continuous air barriers so that all three compliance options associated with air barriers are equivalent.
The current code lists three options for meeting the provisions of the opaque building envelope. The first two that deal with the opaque components are valid and allow compliance based on either the materials used or the assemblies of the envelope. The test is also a valid way of addressing air leakage on a performance basis. Unfortunately, a whole building test includes fenestration such that the test cannot address only opaque sections of the envelope as is the case with the other two options. All three options should be comparable and have the same scope. For this reason the text has been more appropriately rearranged. One approach prescriptively addresses the particular components of the building thermal envelope and their construction and installation as well as individual air leakage properties. The other provides a performance oriented approach that is based on the testing currently allowed, since all possible means of air leakage through the envelope are measured

Cost Impact: The code change proposal will not increase the cost of construction.

CE164-13

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

C402.4-EC-WILLIAMS.doc

CE165 – 13
C402.4

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

C402.4 Air leakage (Mandatory). The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8.

> **Exception:** The provisions of this section shall not be required for roof repairs, roof recovering and roof replacement where the alterations, renovations or repairs to the building do not also include alterations, renovations or repairs to the remainder of the building envelope.

Reason: This code change proposal is intended to clarify the Code's intent regarding when air barriers are and are not required as components of buildings' thermal envelopes.

In existing buildings that do not currently include an air barrier in the building's thermal envelope, it can be interpreted the addition of an air retarder is required in roof repair, roof recover or roof replacement projects where the project's scope does not otherwise require alterations, renovations or repairs to the remainder of the building's thermal envelope. In these situations, the addition of an air retarder to the roof assembly only will do little to and be ineffective in improving the building envelope's overall air leakage performance.

This Exception provides clarity by specifically indicating an air retarder is not required for roof repairs, roof recovering or roof replacement where the scope of the project does not also include alterations, renovations or repairs to the remainder of the building envelope.

Cost Impact: The code change proposal will not increase the cost of construction.

CE165-13

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

C402.4-EC-GRAHAM.doc

CE166 – 13
C402.4.1

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

C402.4.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.4.1.1 and C402.4.1.2.

~~**Exception:** Air barriers are not required in buildings located in Climate Zones 1, 2 and 3.~~

Reason: This proposal deletes the exception for air barriers in Climates Zones 1, 2 and 3. Air barrier use is important to the energy efficiency, moisture performance and comfort in all climate zones and therefore should be included for all climate zones. This change would also make the provisions within the IECC more consistent with both ASHRAE 90.1 and the IgCC.

Cost Impact: The code change proposal will increase the cost of construction in zones 1, 2 and 3.

CE166-13

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

C402.4.1-EC-WESTON.doc

CE167 – 13
C402.4.1.1, C402.4.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.1.1 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section C402.4.2. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals associated with penetrations shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed and shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation

~~3.~~ 4. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Exception: Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 and 4~~3~~.

~~**C402.4.2 Air barrier penetrations.** Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.~~

Reason: This proposal clarifies the language pertaining to the sealing of penetrations in the building envelope. The objective of the proposal is to increase the simplicity of the code.

The provisions of C402.4.2 are currently out of place. They have the same standing in the order of the code as C402.4.1 yet are actually a component of the air barrier provisions. They are more appropriately located as a part of the code text addressing air barrier construction. In addition, the present item 2 is duplicated by C402.4.2 to a large degree so the text has been revised to focus on penetrations.

Cost Impact: The code change proposal will not increase the cost of construction.

CE167-13

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

C402.4.2-EC-WILLIAMS.doc

CE168 – 13
C402.4.1.2, C402.4.1.2.1, C402.4.1.2.2, C402.4.1.2.3

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

Revise as follows:

C402.4.1.2 Air barrier testing ~~compliance~~ ~~options~~. A continuous air barrier for the building envelope shall ~~comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.1~~.

~~**C402.4.1.2.1 Materials.** Materials with an air permeability no greater than 0.004 cfm/ft^2 (0.02 L/s · m^2) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.~~

1. ~~Plywood with a thickness of not less than 3/8 inch (10 mm).~~
2. ~~Oriented strand board having a thickness of not less than 3/8 inch (10 mm).~~
3. ~~Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12 mm).~~
4. ~~Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12 mm).~~
5. ~~Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m3) having a thickness of not less than 11/2 inches (36 mm).~~
6. ~~Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4.5inches (113 mm).~~
7. ~~Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12 mm).~~
8. ~~Cement board having a thickness of not less than 1/2 inch (12 mm).~~
9. ~~Built up roofing membrane.~~
10. ~~Modified bituminous roof membrane.~~
11. ~~Fully adhered single-ply roof membrane.~~
12. ~~A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch (16 mm).~~
13. ~~Cast-in-place and precast concrete.~~
14. ~~Fully grouted concrete block masonry.~~
15. ~~Sheet steel or aluminum.~~

~~**C402.4.1.2.2 Assemblies.** Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s · m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.~~

1. ~~Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;~~
2. ~~A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness.~~

~~**C402.4.1.2.3 Building test.** The completed building shall~~ be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m^2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to code official and the building owner. Where the tested rate exceeds 0.40 cfm/ft^2, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practicable. An additional report identifying the corrective actions taken to seal air leaks shall be submitted to the code official and the building owner, and shall be deemed to satisfy the requirements of this section.

Reason: This proposed amendment requires air barrier testing for building envelopes.

Air leakage through building envelopes wastes significant HVAC energy, and provides a pathway for moisture intrusion into building envelope assemblies. Losses of 30% of conditioned air through uncontrolled air leakage are frequently reported, and mechanical systems must be oversized to accommodate this risk. Air barrier testing greatly reduces loss of conditioned air, providing the best energy savings returns per dollar invested of any technology.

The lists of air barrier materials and assemblies in the 2009 code include common materials such as gypsum board and plywood that in practice qualify almost any contemporary building to meet the code requirements. However, the materials and assemblies themselves are not the main source of air barrier leakage problems – instead, most leakage occurs in the transitions between various materials. Field testing is the only method, short of continuous third-party inspection, that a continuous air barrier can be ensured. Seattle's experience, after mandating that air barriers be tested during this current code cycle (but not requiring that air barriers must meet the test standard) is that all buildings have passed the test.

The proposal eliminates most of the text between C402.4.1.2 and C402.4.1.2.3.1. However with the legislative format it is a little confusing. The net result of this proposal is Section D402.4.1.2 would read as follows:

> **C402.4.1.2 Air barrier testing.** A continuous air barrier for the building envelope shall be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m^2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to code official and the building owner. Where the tested rate exceeds 0.40 cfm/ft^2, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practicable. An additional report identifying the corrective actions taken to seal air leaks shall be submitted to the code official and the building owner, and shall be deemed to satisfy the requirements of this section.

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

CE168-13

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

C402.4.1.2-EC-KRANZ.doc

CE169 – 13
C402.4.1.2, C402.1.4.2.1, C402.4.1.2.2, C402.4.1.2.3

Proponent: Jim Edelson, New Buildings Institute (jedelson@comcast.net), Chris Mathis, Mathis Consulting (Chris@mathisconsulting.com)

Revise as follows:

C402.4.1.2 Air barrier compliance options. ~~A continuous air barrier for the opaque building envelope~~ Buildings less than or equal to 25,000 square feet and less than or equal to 6 stories in height shall comply with Section C402.4.1.2.1. Buildings greater than 25,000 square feet or greater than 6 stories in height shall comply with Section C402.4.1.2.1 or C402.4.1.2.2, ~~or C402.4.1.2.3~~.

~~**C402.4.1.2.1 Materials.** Materials with an air permeability no greater than 0.004 cfm/ft2 (0.02 L/s · m^2) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.~~

1. ~~Plywood with a thickness of not less than 3/8 inch (10 mm).~~
2. ~~Oriented strand board having a thickness of not less than 3/8 inch (10 mm).~~
3. ~~Extruded polystyrene insulation board having a thickness of not less than 1/2 inch (12 mm).~~
4. ~~Foil-back polyisocyanurate insulation board having a thickness of not less than 1/2 inch (12 mm).~~
5. ~~Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m3) having a thickness of not less than 11/2 inches (36 mm).~~
6. ~~Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m3) and having a thickness of not less than 4.5 inches (113 mm).~~
7. ~~Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12 mm).~~
8. ~~Cement board having a thickness of not less than 1/2 inch (12 mm).~~
9. ~~Built up roofing membrane.~~
10. ~~Modified bituminous roof membrane.~~
11. ~~Fully adhered single-ply roof membrane.~~
12. ~~A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch (16 mm).~~
13. ~~Cast-in-place and precast concrete.~~
14. ~~Fully grouted concrete block masonry.~~
15. ~~Sheet steel or aluminum.~~

~~**C402.4.1.2.2 Assemblies.** Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft2 (0.2 L/s · m2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.~~

1. ~~Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;~~
2. ~~A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness.~~

~~**C402.4.1.2.3 Building test**~~ **C402.4.1.2.1 Whole building pressurization testing.** ~~The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official.~~ Compliance of the *continuous air barrier* shall be verified via testing in accordance with ASTM E779 or an equivalent test method approved by the *code official*. The air leakage rate shall not exceed 0.40 cfm/ft^2 of conditioned floor area under a pressure differential of 0.3 in. water (75 Pa).

C402.4.1.2.2 Continuous air barrier commissioning. The *registered design professional* shall provide evidence of *continuous air barrier commissioning* that shall include:

1. Clear identification of *continuous air barrier* components specified for the project and identified on approved construction documents
2. Review of planned construction details to ensure continuity of the air barrier over the entire *building thermal envelope*.
3. A field inspection checklist clearly showing requirements necessary for proper installation of the *continuous air barrier*.
4. Witnessing and reporting on any *continuous air barrier* testing specified by the owner.
5. Periodic field inspections over the course of project construction to ensure compliance with all *continuous air barrier* requirements including, but not limited to, proper material handling and storage, use of approved materials and approved substitutes, proper material and surface preparation, air barrier continuity at all *building thermal envelope* penetrations and other requirements as necessary to achieving the performance objective of the continuous air barrier.
6. A final commissioning report provided to the building owner and *code official* demonstrating compliance with the *continuous air barrier* requirements.

Reason: Buildings typically last for around 100 years. Unlike mechanical systems, the building envelope provisions may be in place for the life of the building and may not be replaced. That is why envelope provisions in new construction are so critically important. However, one of most important variables in envelope performance is not sufficiently addressed by the code – envelope air leakage.

Currently the code has multiple means of code compliance related to air leakage, relying on the tested performance of materials and assemblies and allowing for whole-building testing. But whole-building air leakage is not about the materials used. It is not about the assemblies employed. Instead, it is about how well all of the materials and assemblies go together.

Fortunately for the past few code cycles the energy code has increasingly prioritized reduction of uncontrolled air leakage – in duct work and through building envelopes. This is due in part to the growing recognition of the energy penalties associated with unwanted air leakage. Fortunately, the building industry also has continued to innovate and develop an array of product offerings specifically designed to help reduce air leakage, as well as develop improved, low-cost techniques for measuring air leakage on site.

This code proposal prioritizes control and measurement of envelope air leakage. It requires testing of small buildings and allows for commissioning of the continuous air barriers already required by the code.

The proposed language follows similar language from ASHRAE Guideline 0, NIBS Guideline 3 and Army Corp of Engineers Test Protocol for Building Envelopes. It aims to ensure that buildings actually meet the air leakage requirements of the code, regardless of the materials, systems or assemblies employed. It is based on the fundamental understanding that durable, long-term energy performance of a building actually requires proven compliance with the continuous air barrier objectives and air leakage requirements.

Uncontrolled air leakage is a significant contributor to moisture, comfort and energy problems in building envelopes. Moisture problems can cause mold and rot, can weaken the integrity of exterior walls, can degrade the performance of certain insulations, and can lead to poor indoor temperature, humidity and air quality control. Well-installed air barriers in commercial and industrial buildings are estimated to reduce air leakage by up to 83 percent, save on gas bills by more than 40 percent and cut down on electrical consumption as much as 25 percent, according to simulations by the National Institute of Standards and Technology (NIST).

This proposal is intended to target improved code compliance. Over 85 percent of the commercial buildings we build are less than 25,000 square feet in size. Buildings of this size can easily be tested to determine actual air leakage. Over the past two decades, the number of qualified air leakage testing professionals has grown to be able to address this need. If the code says "have envelope air leakage less that x" – then we can now easily measure it to ensure compliance. Whole-building testing is currently required for all US General Services Administration and Army Corps of Engineers projects.

This proposal is intended to be flexible. Some buildings can be harder to test. When buildings get over 10 stories in height or over 25,000 square feet, the code needs some other ways to ensure that a code-compliant continuous air barrier is in place and ready to perform to meet the requirements of the code. This proposal allows for the option to either test or commission the installation of the continuous air barrier on the building. This second option is being employed more and more as the recognition of the importance of air barrier commissioning grows. In the absence of testing, on-site quality assurance of air barrier insulation is essential regardless of the materials and assemblies used.

The new commissioning alternative for demonstrating compliance is in line with other policy objectives of the ICC. As a compliance option for continuous air barrier performance, commissioning offers both flexibility and firmer assurances that building envelopes will perform as intended over the useful life of the building.

> "The term commissioning comes from ship builders that "commission" their ships to ensure that they are ready for service prior to the ships initial voyage and then are routinely inspected or "retrocommissioned" during their service life to maintain their performance.
>
> An important yet underused path to energy savings, greenhouse gas emission reductions and overall building performance is through the commissioning of new buildings and the retrocommissioning of existing stock. In recent years commissioning has found its way into voluntary rating systems like LEED and, more recently, it has been included in the *International Green Construction Code*™ (IgCC™) and CALGreen building codes, and standards such as ASHRAE

> 189.1, which is helping to move it into the mainstream of construction practices." Source: ICC G4-2012 Guideline for Commissioning

Envelope air tightness fundamentally is not about materials or assemblies. It is a performance objective. The code needs to improve the enabling structures to provide building inspectors, as well as owners and occupants, assurance of air barrier performance. This proposal offers two proven techniques for actually ensuring compliance with the code, as well as ensuring meeting the code's stated intent:

> **R101.3 Intent.** This code shall regulate the design and construction of buildings for the ***effective use and conservation of energy over the useful life of each building***. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances. Source: 2012 IECC. (emphasis added)

Cost Impact: The code change proposal will not increase the cost of construction.

CE169-13

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

C402.4.1.2-EC-EDELSON-MATHIS.doc

CE170 – 13
C402.4.1.2.1, C402.4.1.2.2

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

C402.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, or C402.4.1.2.3.

C402.4.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft^2 (0.02 L/s · m^2) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. ~~Materials in Items 1 through 15 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.~~

1. ~~Plywood with a thickness of not less than 3/8 inch (10 mm).~~
2. ~~Oriented strand board having a thickness of not less than 3/8 inch (10 mm).~~
3. ~~Extruded polystyrene insulation board having a thickness of not less than ½ inch (12 mm).~~
4. ~~Foil-back polyisocyanurate insulation board having a thickness of not less than ½ inch (12 mm).~~
5. ~~Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m^3) having a thickness of not less than 1½ inches (36 mm).~~
6. ~~Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4.5 inches (113 mm).~~
7. ~~Exterior or interior gypsum board having a thickness of not less than 1/2 inch (12 mm).~~
8. ~~Cement board having a thickness of not less than 1/2 inch (12 mm).~~
9. ~~Built up roofing membrane.~~
10. ~~Modified bituminous roof membrane.~~
11. ~~Fully adhered single-ply roof membrane.~~
12. ~~A Portland cement/sand parge, or gypsum plaster having a thickness of not less than 5/8 inch (16 mm).~~
13. ~~Cast-in-place and precast concrete.~~
14. ~~Fully grouted concrete block masonry.~~
15. ~~Sheet steel or aluminum.~~

C402.4.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s · m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. ~~Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.~~

1. ~~Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;~~
2. ~~A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness.~~

Reason: This proposal deletes the "laundry lists" of generic materials and assemblies deemed to comply with the air barrier requirements. As there is a performance criteria and test method specified in the code for air barrier materials this list potentially confuses this requirement because the code would also allow any materials equivalent to this list. The list itself contains unspecified materials so that checking compliance would be difficult. Such deemed to comply lists are better suited for a commentary rather than in the code itself.

Cost Impact: The code change proposal will not increase the cost of construction.

CE170-13

Public Hearing:	Committee:	AS	AM	D

Assembly: ASF AMF DF

C402.4.1.2.1-EC-WESTON.doc

CE171 – 13
C402.4.1.2

Proponent: Tim M. Mattox, Tremco, Inc. (tmattox@tremcoinc.com)

Revise as follows:

C402.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall comply with Section C402.4.1.2.1, C402.4.1.2.2, ~~or~~ and C402.4.1.2.3.

Reason: The intention of this code section is to identify proper steps are taken to ensure the installation of an effective air barrier. In current form, this code section provides for options to choose a proper material (402.4.1.2.1), or to choose a properly tested assembly (402.4.1.2.2), or to test the application of the material/assembly once applied in a building (402.4.1.2.3). Ultimately the goal is to pass the third option, but for the design phase of a project it is difficult to know if a material or an assembly that has not been tested to the first two options would have a chance at passing the third option. Once a building is constructed, it becomes very costly to fix the problem if an underperforming material and application is selected. The requirements for this section should establish that air barrier compliance should be based on a material and application that has successfully met the requirements of Sections 402.4.1.2.1 and 402.4.1.2.2, and that the end result should meet the requirements of 402.4.1.2.3.

This code change proposal intends to clarify that an effective air barrier system needs to utilize the proper materials, be tested as an assembly to ensure the design can effectively prevent air leakage with some durability, **and** that the systems have been installed properly.

Cost Impact: While there may be an increase in the cost of construction, proper materials, design, and installation will ultimately reduce cost and use of energy. Proper sequencing will help to ensure the end result is achieved while mitigating costly repair work.

CE171-13

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

C402.4.1.2-EC-MATTOX.doc

CE172 – 13
C402.4.1.2.1

Proponent: Tim M. Mattox, Tremco, Inc.(tmattox@tremcoinc.com)

Revise as follows:

C402.4.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft^2 (0.02 L/s • m^2) under a pressure differential of 0.3 inches water gauge (w.g.) (75 Pa) when tested in accordance with ASTM E 2178 shall comply with this section. Materials in Items 1 through 15 shall be deemed to comply with this section provided joints <u>and penetrations</u> are sealed <u>in accordance with Section C402.4.2</u> and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $^3/_8$ inch (10 mm).
2. Oriented strand board having a thickness of not less than $^3/_8$ inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than $^1/_2$ inch (12 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $^1/_2$ inch (12 mm).
5. Closed cell spray foam a minimum density of 1.5 pcf (2.4 kg/m^3) having a thickness of not less than $1^1/_2$ inches (36 mm).
6. Open cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12 mm).
8. Cement board having a thickness of not less than $^1/_2$ inch (12 mm).
9. Built up roofing membrane.
10. Modified bituminous roof membrane.
11. Fully adhered single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $^5/_8$ inch (16 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.

Reason: The first change adds penetrations to the building elements that need to be properly installed in the "deemed to comply" solutions. This is consistent with the remainder of Section C402. The second change references existing language for proper treatment of joints and penetrations in air barriers.

The addition of the specific reference to penetrations simply reflects the current intent and it ensures any breach of the air barrier membrane is restored.

Cost Impact: This code change proposal will not increase the cost of construction.

CE172-13

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

C402.4.1.2.1-EC-MATTOX.doc

CE173 – 13
C402.4.1.2.1

Proponent: Charles Clark, Brick Industry Association, representing Masonry Alliance for Codes and Standards (cclark@bia.org)

Revise as follows:

402.4.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft^2 (0.02 L/s·m^2) under a pressure differential of 0.3 in. water (w.g.)(75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in items 1 through ~~15~~ 16 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

16. Solid or fully grouted masonry constructed of clay or shale masonry units.

(Portions of text not shown remain unchanged)

Reason: Testing will show that fully grouted masonry constructed of clay or shale masonry units can meet the IECC requirements to be a material deemed-to-comply as an air barrier. This research is being conducted at the National Brick Research Center and will be available in time for consideration at the ICC Committee Hearings.

Cost Impact: This code change will not increase the cost of construction.

CE173-13

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

C402.4.1.2.1-EC-CLARK.doc

CE174 – 13
C402.4.1.2.2

Proponent: Tim M. Mattox, Tremco, Inc. (tmattox@tremcoinc.com)

Revise as follows:

C402.4.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s • m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357,or ASTM E 1677 ~~or ASTM E 283~~ shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum $^1/_2$ inch (12 mm) in thickness.

Reason: An ASTM E2357 test prescribes running an ASTM E283 test twice during the course of testing - once before a wind conditioning sequence and once afterward. The E2357 test method also addresses the measurement of air leakage over a range of pressure differences and not just at 75 Pa, although the standard indicates that the air leakage rate of an assembly is reported as the leakage measured at a 75 Pa pressure differential. Allowing ASTM E283 by itself as an option to ASTM E2357 is a redundancy, except it leaves out the critical step of understanding how well a system accommodates movement. This is important to understand because movement will be realized as soon as a structure is erected and will endure for the life of a building. This revision also makes the text consistent with Normative Appendix B, subsection b of ASHRAE 189.1.

NFRC 400-2010 states the following when referencing ASTM E283 as a standard for measuring air leakage under test criteria note to item H:

"This procedure references the use of ASTM E283 as the only method for measuring individual product air leakage rates. ASTM E283 is a laboratory test method that has been used for many years to measure air leakage rates under controlled conditions. Because this test method measures air leakage rates at only one pressure differential, it is best used to compare the relative performance of fenestration products. It does not directly provide information on how a product will perform in a specific building application at field conditions."

Cost Impact: This change may have an effect on the cost of construction. ASTM E2357 is a more thorough test, having greater duration and greater cost than simply testing to ASTM E283, but the added benefit of installing more durable systems is likely to reduce costs of operation over time.

CE174-13

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

C402.4.1.2.2-EC-MATTOX.doc

CE175 – 13
C402.4.1.2.2

Proponent: Charles Clark, Brick Industry Association, representing Masonry Alliance for Codes and Standards (cclark@bia.org)

Revise as follows:

402.4.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s·m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in items 1 ~~and 2~~ through 3 shall be deemed to comply provided joints are sealed and requirements of Section 402.4.1.1 are met.

1. Concrete masonry walls coated with either one application ~~either~~ of block filler or ~~and~~ two applications of a paint or sealer coating;
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4-inches or more;
3. ~~2.~~ A Portland cement/sand parge, stucco or plaster minimum ½ inch (12 mm) in thickness.

Reason: This code change proposal modifies or adds text to the air barrier assembly section in two ways. It corrects the current requirement for a concrete masonry wall assembly to comply as an air barrier. And it adds an assembly option for masonry walls constructed of clay or shale masonry units.

The current text for concrete masonry walls is incorrectly worded. As was substantiated by testing submitted with code change proposal EC 146-09/10, a concrete masonry wall assembly is able to comply as an air barrier when EITHER (not both) of the following are applied:

1) One application of block filler, or
2) Two applications of a paint or sealer coating.

Testing to support both of these methods of compliance was previously submitted with EC146-09/10 and can be downloaded at the following URL: www.ncma.org/resources/design/Research%20Reports/MR36.pdf.

This code change proposal also adds an option for masonry construction made from clay or shale masonry units to qualify as an air barrier. Testing will show that masonry constructed of clay or shale masonry units can meet the IECC requirements to be an assembly deemed-to-comply as an air barrier. This research is being conducted at the National Brick Research Center and will be available in time for consideration at the ICC Committee Hearings.

Cost Impact: This code change proposal will not increase the cost of construction.

CE175-13

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

C402.4.1.2.2-EC-CLARK.doc

CE176 – 13
C402.4.1.2.2

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Revise as follows:

C402.4.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s · m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in Items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section C402.4.1.1 are met.

1. ~~Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;~~
2. ~~A Portland cement/sand parge, stucco or plaster minimum $^1/_2$ inch (12 mm) in thickness.~~

Reason: This list is incomplete as common assemblies that could meet the requirement, or the incomplete list should be deleted. For example, the list should include ICF, a spray foam 1" or more, SIPS, and usually a high-density cellulose. No list is better than an incomplete list.

Cost Impact: The code change proposal will not increase the cost of construction.

CE176-13

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

C402.4.1.2.2-EC-CONNER.doc

CE177 – 13
C402.4.1.2 (NEW), R402.1.2 (NEW), (IRC N1102.4.1.2 (NEW))

Proponent: Brent Ursenbach, Salt Lake County representing Utah Chapter ICC and Utah Association of Plumbing and Mechanical Officials Chapter ICC (bursenbach@slco.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C 402.4.1.2 Combustion air openings. In climate zones 3 through 8, where open combustion air ducts provide combustion air to open combustion space conditioning fuel burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table C402.1.2 or C402.2, where the walls shall meet a minimum of the below-grade wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section C403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Sections 901, 902, 903, 904, and 905 of the *International Mechanical Code*, and Section 2111.13 of the *International Building Code.*

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R402.4.1.2 (N1102.4.1.2) Combustion air openings. In climate zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.1, where the walls shall meet a minimum of the basement wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Section 402.4.2 and Section R1006 of the *International Residential Code*.

Reason: (Part I) The entire section C402.4 Air leakage- is of little value when a combustion air duct is installed, open to the conditioned space, virtually placing a large hole through the thermal envelope. The building testing option for leakage in C402.4.1.2.3 cannot be accomplished with a combustion air opening inside the thermal envelope. Testers regularly block these opening as this is the only way they can pressurize the building; only to be opened after the test is completed. Ideally, direct vent, sealed combustion appliances solve the problem. Where less efficient, open combustion fuel burning appliances are used, it is reasonable and proper to isolate the appliances and the required combustion air from inside the thermal envelope.
(Part II) The entire section N1102.4 Air leakage- is of little value when a combustion air duct is installed, open to the conditioned space, virtually placing a large hole through the thermal envelope. Blower door testing as now required by the code cannot be accomplished with a combustion air opening inside the thermal envelope. Testers regularly block these opening as this is the only

way they can pressurize the home; only to be opened after the test is completed. Ideally, direct vent, sealed combustion appliances solve the problem. Where less efficient, open combustion fuel burning appliances are used, it is reasonable and proper to isolate the appliances and the required combustion air from inside the thermal envelope.

Cost Impact: The code change proposal will increase the cost of construction, while it will reduce the energy consumption and cost throughout the life of the home.

CE177-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C402.4.1.2 (NEW)-EC-URSENBACH.doc

CE178 – 13
C402.4.2

Proponent: Tim M. Mattox, Tremco, Inc. (tmattox@tremcoinc.com)

Revise as follows:

C402.4.2 Air barrier penetrations and joints. Penetrations, joints and gaps of the air barrier, and paths of air leakage shall be caulked, gasketed, covered with a moisture vapor-permeable wrapping material, or otherwise sealed in a manner compatible with the construction materials and location. ~~Joints and seals gaps shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material.~~ ~~Sealing~~ Air barrier materials shall be appropriate to the construction materials being sealed. The ~~joints and seals~~ air barrier materials shall be securely installed in or on the joint for its entire length, or penetration, so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

Reason: These proposed changes are intended to clean up the code language

Cost Impact: This code change proposal will not increase the cost of construction.

CE178-13

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

C402.4.2-EC-MATTOX.doc

CE179 – 13
C402.4.2, Table R402.4.1.1 (IRC Table N1102.4.1.1)

Proponent: Jeffrey M. Hugo, CBO, National Fire Sprinkler Association (hugo@nfsa.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.4.2 Air barrier penetrations. Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

Exception:

1. Penetrations of the air barrier for a*utomatic* sprinkler systems installed according to the *International Building Code* or the *International Fire Code*,

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

TABLE R402.4.1.1 (N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Automatic sprinkler systems	Penetrations of the building envelope for *automatic* sprinkler systems installed according to the *International Residential Code*, *International Building Code* and *International Fire Code* are exempt from being sealed.
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be insulated and the junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.

	Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.
Rim joists	Rim joists shall be insulated and include the air barrier.
Floors (including above-garage and cantilevered floors)	Insulation shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.
Narrow cavities	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air tight, IC rated, and sealed to the drywall.
Plumbing and wiring	Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall be insulated and the air barrier installed separating them from the showers and tubs.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. Fireplaces shall have gasketed doors.

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

Reason: (Part I) This proposal seeks to exempt fire sprinkler systems, specifically pendent sprinklers (and other similar sprinklers), that penetrate the typical building envelope at the ceilings by adding an exception.

Section C402.4.2 of the 2012 IECC states that the penetrations in the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Caulking the sprinkler, escutcheon, or cover plate could delay, cease or interrupt the flow of the fire sprinkler. In cases when a concealed pendent fire sprinkler is used, the caulk may adhere to the cover plate to the ceiling material and severely delay the fast response of the sprinkler.

Caulked Concealed

The same IECC section above, also states that the “sealing materials shall be appropriate to the construction materials being sealed”. Caulk and other sealants are never compatible with the sprinklers, escutcheons and cover plates. In fact, some caulks and sealants are chemically incompatible with certain piping and the pipe manufacturers shall be consulted prior to applying any material.

The fire sprinkler, escutcheon and cover plate are designed to fit together without any adhesive. Escutcheons and cover plates can have gaps or spaces that are required to meet certain specification tolerances for activation of the sprinkler, but in most cases the escutcheons and cover plates should fit tightly to the wall or ceiling.

Furthermore, the intent of the IECC (Section C101.3) is not “intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.” When fire sprinklers are installed or required by other codes such as the IBC, they are installed according to those referenced standards. Fire sprinklers are installed by NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 13R (Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height) and NFPA 13D (Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes) along with IRC Section P2904.

These codes and standards require that all fire sprinklers, escutcheons and cover plates be listed and installed according to that listing. The testing and listing process (of fire sprinklers, escutcheons, and cover plates) does not take into account any additional field applied materials on the sprinkler, escutcheon and cover plate, such as: paint, caulk, drywall compound, and other construction materials. This prohibition is not only reiterated, but is enforced by NFPA 13 and NFPA 25 (Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems) as both of these standards require full replacement of the affected components when found. When a fire sprinkler is properly installed, the escutcheon and/or cover plate should adequately seal the penetration.

(Part II) This proposal seeks to exempt fire sprinkler systems, specifically pendent sprinklers (and other similar sprinklers), which penetrate the typical building envelope at the ceilings by adding a new automatic sprinkler systems row in the component and criteria columns of Table R402.4.1.1.

NFSA fire sprinkler contractors are reporting that local authorities and building owners are caulking fire sprinklers in order to pass the air leakage testing. Caulking the sprinkler, escutcheon, or cover plate could delay, cease or interrupt the flow of the fire sprinkler. In cases when a concealed pendent fire sprinkler is used, the caulk may adhere to the cover plate to the ceiling material and severely delay the fast response of the sprinkler.

Caulk and other sealants are never compatible with the sprinklers, escutcheons and cover plates. In fact, some caulks and sealants are chemically incompatible with certain piping and the pipe manufacturers shall be consulted prior to applying any material.

The fire sprinkler, escutcheon and cover plate are designed to fit together without any adhesive. Escutcheons and cover plates can have gaps or spaces that are required to meet certain specification tolerances for activation of the sprinkler, but in most cases the escutcheons and cover plates should fit tightly to the wall or ceiling.

The intent of the IECC (Section R101.3) is not “intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.” When fire sprinklers are installed or required by other codes such as the IBC, they are installed according to those referenced standards. Fire sprinklers are installed by NFPA 13 (Standard for the Installation of Sprinkler Systems), NFPA 13R (Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height) and NFPA 13D (Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes) along with IRC Section P2904.

These codes and standards require that all fire sprinklers, escutcheons and cover plates be listed and installed according to that listing. The testing and listing process (of fire sprinklers, escutcheons, and cover plates) does not take into account any additional field applied materials on the sprinkler, escutcheon and cover plate, such as: paint, caulk, drywall compound, and other construction materials. This prohibition is not only reiterated, but is enforced by NFPA 13 and NFPA 25 (Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems) as both of these standards require full replacement of the affected components when found. When a fire sprinkler is properly installed, the escutcheon and/or cover plate should adequately seal the penetration.

Cost Impact: The code change proposal will not increase the cost of construction.

CE179-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C402.4.2-EC-HUGO. doc

CE180 – 13
Table C402.4.3

Proponent: Jeff Inks, Window & Door Manufacturers Association (jinks@wdma.com)

Revise as follows:

TABLE C402.4.3
MAXIMUM AIR INFILTRATION RATE
FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Fixed ~~W~~windows	0.20[a]	AAMA/WDMA/ CSA101/I.S.2/A440 or NFRC 400
Operable windows	0.30	
Sliding doors	~~0.20[a]~~ 0.30	
Swinging doors	~~0.20[a]~~ 0.50	
Skylights ~~– with condensation weepage openings~~	0.30	
~~Skylights – all others~~	~~0.20[a]~~	

(Portions of Table not shown remain unchanged)

For SI: 1 cubic foot per minute = 0.47L/s, 1 square foot = 0.093 m2.

~~a. The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).~~

Reason: During the last code development cycle as part of the comprehensive commercial revisions included in EC-147-09/10, air infiltration rates for windows, skylights, sliding doors and swinging doors were arbitrarily lowered without sound technical justification. Rather the only substantiation that was cited was debatable modeling which was said to show such reductions in air infiltration rates may improve performance by 1-2% in some types of commercial buildings and was not sufficiently comprehensive to justify lowering the rates to 0.20 cfm, especially for all types of commercial construction covered by the IECC. Other modeling can show gains are far less 1-2%.

Regardless of what modeling is used, the energy efficiency gains in the envelope and overall building efficiency as a result of the reduced rates are minimal at best and need to be more thoughtfully weighed against the negative impacts that result from them, primarily for operable fenestration which is the focus of this proposal. These include added costs to production, testing, and labeling for all products, increase in operational force (especially sliding fenestration products) which impairs operability for all users (and adds difficulty in meeting accessibility requirements) because of the additional sealing that would be required. In addition, the values also conflict with the values in AAMA/WDMA/CSA 101/I.S.2/A440.

In addition, if there are concerns that air infiltration rates for operable fenestration need to be made more stringent, they should be addressed in AAMA/WDMA/CSA 101/I.S.2/A440 and not in the body of the IECC.

For these reasons coupled with the minimal gains in building efficiency that may be achieved, we believe the reduction in air infiltration rates for operable fenestration is unjustified and unnecessary and that the rates should therefore be returned as proposed. It should be noted that this proposal maintains the air infiltration rate of 0.20 cfm for fixed windows.

Cost Impact: This code change proposal will not increase the cost of construction. This code change proposal will decrease the cost of construction.

CE180-13

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

C402.4.3-EC-INKS.doc

CE181 – 13
C402.4.3, Table C402.4.3

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

Revise as follows:

C402.4.3 Air leakage of fenestration. The air leakage of fenestration assemblies shall meet the provisions of Table C402.4.3. Testing shall be in accordance with the applicable reference test standard in Table C402.4.3 by an accredited, independent testing laboratory and *labeled* by the manufacturer.

Exceptions:

1. Field-fabricated fenestration assemblies that are sealed in accordance with Section C402.4.l.
2. Fenestration in buildings that comply with Section C402.4.1.2.3 are not required to meet the air leakage requirements in Table C402.4.3.
3. Metal coiling doors in semi-heated spaces in climate zones 1 through 6 are not required to meet the air leakage requirements in Table C402.4.3.

TABLE C402.4.3
MAXIMUM AIR ~~INFILTRATION~~ LEAKAGE RATE
FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT²)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/ CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights - with condensation weepage openings	0.30	
Skylights - all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E 283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	0.06	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
~~Rolling doors~~	~~1.00~~	

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^2

a. The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).

Reason: Rolling doors do not meet air leakage requirements, because their interlocking slat design is not intended for air leakage control. Such doors are typically used in semi-heated spaces, because they are associated with applications such as parking, storage and warehousing. The Exception is proposed to match similar language currently in ASHRAE 90.1. The proposed Table heading revision is editorial, for consistency with the language in C402.4.3.

Cost Impact: The code change proposal will not increase the cost of construction.

CE181-13

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

C402.4.3-EC-HETZEL.doc

CE182 – 13
Table C402.4.3

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

Revise as follows:

**TABLE C402.4.3
MAXIMUM AIR INFILTRATION RATE
FOR FENESTRATION ASSEMBLIES**

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/ CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights - with condensation weepage openings	0.30	
Skylights - all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E 283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	0.06	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
<u>High speed doors[b]</u>	<u>1.30</u>	

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^2

a. The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).
<u>b. A non-swinging door intended for vehicular access and material transportation, with a minimum opening rate of 32 inches per second</u>

Reason: "High speed doors" are typically automatically controlled, non-swinging doors, and are commonly used in conjunction with vehicular traffic or transportation of materials and are not generally intended for pedestrian traffic. Sizes typically range from 8x8 to 12x12. When high speed doors are used in a building exterior envelope, the primary purposes are for environmental control and/or building security.

High speed door panels or curtains are usually made of a thin layer of vinyl, fabric, rubber or composite material. Materials can be opaque, translucent or a combination thereof.

The assemblies are constructed of flexible materials at the perimeter to provide sealing against air leakage but yet to allow variations in contact between door panels/curtains and jamb construction to maximize the effectiveness of continual high speed operation. Thus, high speed doors cannot comply with prescriptive air leakage requirements for any current fenestration assembly type in Table C402.4.3. The high speed nature of these doors provides for minimizing of "air exchange", a valuable and predominant characteristic of minimizing overall energy losses through a door opening.

An air leakage value of 1.30 cfm/sf is recommended for a high speed door based on a tested value of 1.26 obtained via a March 2012 DASMA-sponsored test on a representative 8'x8' high speed door product.

Cost Impact: This code change proposal will not increase the cost of construction.

CE182-13

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

C402.4.3T-EC-HETZEL.doc

CE183 – 13
C402.4.4

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies. Doors and access openings from conditioned space to shafts, chutes, stairways and elevator lobbies not within the scope of the fenestration assemblies covered in Section C402.4.3 shall ~~either meet the requirements of Section C402.4.3 or shall~~ be gasketed, weatherstripped or sealed.

> **Exception:** Door openings required to comply with Section 715 ~~or 715.4~~ of the *International Building Code*; or doors and door openings required to comply with UL 1784 by the International Building Code ~~to comply with UL 1784 shall not be required to comply with Section C402.4.4~~.

Reason: This proposal clarifies the components covered in the section on doors and access openings to shafts, chutes, stairways, and elevator lobbies are subject to air leakage provisions as components of the building thermal envelope, and provides a distinction between these doors and other doors that are already covered within the scope of fenestration assemblies. The objective of this proposal is to clarify the code to foster implementation and compliance verification.

Some doors are covered by Section C402.4.3 and the intent of the code should be that doors within the scope of fenestration that can be tested and listed *should* be tested and listed in accordance with and meet the provisions of Section C402.4.3. This leaves those doors that cannot be so tested and listed subject to the caulking and sealing criterion. This clarification is needed because the current code allows some doors that could (and should) be assessed as meeting the provisions of Section C402.4.3 through testing and listing only required to be "caulked or sealed." The exception is revised to provide clarification and to eliminate the ending statement—an exception by definition means something is not required to comply.

Cost Impact: The code change proposal does not increase the cost of construction.

CE183-13

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

C402.4.4-EC-WILLIAMS.doc

CE184 – 13
C402.4.4, C402.4.5, C402.4.5.1, C402.4.5.2, C403.2.4.4 (NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

~~**C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies.** Doors and access openings from conditioned space to shafts, chutes stairways and elevator lobbies shall either meet the requirements of Section C402.4.3 or shall be gasketed, weatherstripped or sealed.~~

> ~~**Exception:** Door openings required to comply with Section 715 or 715.4 of the *International Building Code*; or doors and door openings required by the *International Building Code* to comply with UL 1784 shall not be required to comply with Section C402.4.4.~~

C402.4.5 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section~~s C402.4.5.1 and C402.4.5.~~2 <u>C403.2.4.4.</u>

~~**C402.4.5.1 Stairway and shaft vents.** Stairway and shaft vents shall be provided with Class I motorized dampers with a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

~~Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:~~

1. ~~The activation of any fire alarm initiating device of the building's fire alarm system; or~~
2. ~~The interruption of power to the damper.~~

~~**C402.4.5.2 Outdoor air intakes and exhausts.** *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers with a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

~~**Exceptions:**~~

1. ~~Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft^2 (101.6 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:~~
   - ~~1.1 In buildings for exhaust and relief dampers.~~
   - ~~1.2 In buildings less than three stories in height above grade.~~
   - ~~1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.~~
   - ~~1.4. Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm (141 L/s).~~

   ~~Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.~~
2. ~~Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft^2 (203.2 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

<u>**C403.2.4.4 Shutoff dampers.** Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class 1 motorized dampers having a maximum air leakage rate of 4 cfm/ft^2 of damper surface area at 1.0 inch water gauge when tested in accordance with AMCA 500D.</u>

Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation unless the systems served require outdoor or exhaust air in accordance with the *International Mechanical Code* or the dampers are opened to provide intentional economizer cooling.

Stairway and shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper.

Exceptions: Gravity (non-motorized) dampers shall be permitted to be used as follows:

1. In buildings less than three stories in height above grade plane.

2. In buildings of any height in climate zones 1, 2 or 3.

3. Where the design exhaust capacity is not greater than 300 cfm.

All gravity (non-motorized) dampers shall have a maximum air leakage rate of 20 cfm/ft^2 where not less than 24 inches in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D.

Reason: This proposal consolidates all provisions associated with leakage rates, sealing, dampers, etc. of mechanical system openings, vents, grills, etc. for air intakes, exhaust openings, stairways and shafts in one place in the code. The objective of this proposal is to clarify the code to foster implementation and compliance verification.

Currently shutoff dampers are covered in two places (envelope and mechanical) and based on experiences with energy code trainings is causing confusion. There is also a conflict in the current code where exhaust and relief dampers are allowed to be gravity dampers no matter the building height in Section C402.4.5.2 and per Section C403.2.4.4 only up to three stories in height in the mechanical section in Climate Zones 4-8. Because all exhaust and relief dampers are associated with mechanical systems, the more stringent requirement in the mechanical section is retained. Locating all the provisions in one place will eliminate this confusion and current and potential future conflicts. It is important to note that the code change does not change the technical content of the current code (other than addressing the above mentioned conflict) and simply places all the requirements in one better organized location in the code, noting Section 402.4.5 is retained in the envelope section of the code and refers the user to Section 403.2.4.4 where all damper provisions would be located.

A summary of the current code provisions in C402.4.5 and C403.2.4.4 finds the following:

- Stairway enclosures and elevator shaft vents need to have motorized dampers with 4.0 or less leakage and have controls allowing the dampers to automatically open with a fire alarm or power interruption.
- Outdoor air and exhaust openings integral to the building envelope need to have the same motorized damper leakage rate but in some cases these openings can be provided with gravity (non-motorized) dampers meeting certain leakage limits.
- Outdoor air supply and exhaust ducts need to have motorized dampers but no leakage limit is provided and gravity dampers are allowed in some cases.

The proposed code change contains all those provisions so the outcome from following the current code and the code change proposal above is the same, except where the current code provisions conflict, in which case the more specific or stringent has been applied in the code change proposal.

Cost Impact: The code change proposal does not increase the cost of construction.

CE184-13

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

C402.4.5-EC-WILLIAMS.doc

CE185 – 13
C402.4.5, C402.4.5.1, C402.4.5.2, C403.2.4.4, C403.3.1.1.5 (New)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C402.4.5 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section C403.2.4.4. ~~s C402.4.5.1 and C402.4.5.2~~.

C403.2.4.4 Shutoff dampers. ~~controls.~~ ~~Both outdoor air supply and exhaust ducts shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use.~~

~~**Exceptions:**~~

1. ~~Gravity dampers shall be permitted in buildings less than three stories in height.~~
2. ~~Gravity dampers shall be permitted for buildings of any height located in Climate Zones 1, 2 and 3.~~
3. ~~Gravity dampers shall be permitted for outside air intake or exhaust airflows of 300 cfm (0.14 m3/s) or less.~~

Stairway and shaft vent shutoff dampers shall comply with Section C403.2.4.4.1 and outdoor air intakes and exhausts shall comply with Section C403.2.4.4.2.

~~C402.4.5.1~~ C403.2.4.4.1 Stairway and shaft vent shutoff dampers. Stairway and shaft vents shall be provided with Class I motorized dampers with a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D. Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:
1. The activation of any fire alarm initiating device of the building's fire alarm system; or
2. The interruption of power to the damper.

~~C402.4.5.2~~ C403.2.4.4.2 Outdoor air intakes and exhausts. Outdoor air supply and exhaust openings in the building envelope, ducts, or equipment shall be provided with Class 1 ~~IA~~ motorized dampers with a maximum leakage rate of 4 cfm/ft^2 (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D. Outdoor air supply and exhaust motorized dampers shall be configured to automatically shut when the systems or spaces served are not in use.

Exceptions:

1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft^2 (101.6 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:
   - 1.1. In buildings less than three stories in height above grade plane for exhaust and relief dampers.
   - 1.2. ~~In buildings less than three stories in height above grade.~~
   - ~~1.3.~~ For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.
   - ~~1.4.~~ 1.3. Where the design outdoor air intake or exhaust capacity does not exceed 300 cfm (141 L/s).

   Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.

2. Gravity (nonmotorized) dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft^2 (203.2 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

3. Dampers are not required for:
   3.1. Ventilation or exhaust systems serving unconditioned spaces.
   3.2. Exhaust systems serving Type 1 kitchen exhaust hoods.

C403.3.1.1.5 Dampers. Exhaust/relief, and *outdoor air* dampers shall comply with Section C403.2.4.4.1 outdoor air intakes and exhausts.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised. The change ensures continued consistency between the IECC and standard 90.1-2010. Currently the damper class associated with 4.0 cfm/ft^2 leakage is Class 1 (not Class IA – which is a 3.0 leakage rate) such that all dampers have the same classification and leakage rate provision. Damper provisions have been consolidated into the mechanical section to avoid inconsistency or confusion and are referenced from the envelope section.

Cost Impact: The code change proposal will not increase the cost of construction.

CE185-13

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

C402.4.5-EC-FERGUSON.doc

CE186 – 13
C402.4.5.1

Proponent: Amanda Hickman, Intercode Incorporated, representing AMCA International (Amanda@intercodeinc.com)

Revise as follows:

C402.4.5.1 Stairway and shaft vents. Stairway and shaft vents shall be provided with Class I motorized dampers. Dampers shall have ~~with~~ a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) and shall be labeled by an *approved agency* when tested in accordance with AMCA 500D for such purpose.

Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:

1. The activation of any fire alarm initiating device of the building's fire alarm system; or
2. The interruption of power to the damper.

Reason: This change will make enforcement faster and easier. Applying sealed (low-leakage) dampers in the building envelope will save energy and will be more easily enforced because of the presence of a certification label.

The requirement for labeling dampers is already required in the International Building Code for fire and smoke dampers. However, there is no such labeling requirement for sealed low leakage dampers that indicates the certified air leakage rating verified by an approved third party agency. This is an important tool for designers and inspectors to ensure that the appropriate equipment is specified and installed.

There is no significant cost increase since the majority of damper manufacturers already have their products certified, and are already providing labels for other types of dampers. There may be some small increase in the cost of dampers for a manufacturer who are not already voluntarily participating in a certified ratings program.

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

CE186-13

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

C402.4.5-EC-HICKMAN.doc

CE187 – 13
C402.4.5.2

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International

Revise as follows:

C402.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class ~~IA~~ I motorized dampers with a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

Exceptions:

1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft^2 (101.6 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:
   - 1.1. In buildings for exhaust and relief dampers.
   - 1.2. In buildings less than three stories in height above grade.
   - 1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.
   - 1.4. Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm (141 L/s).

   Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.
2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft^2 (203.2 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

Reason: This change is an editorial correction. The leakage specification of 4 cfm/ft2 pertains to Class I, not Class IA, so the "A" needs to be dropped. Class 1A has a maximum leakage rate of 3 cfm/ft2.

Cost Impact: This proposal will not increase the cost of construction.

CE187-13

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

C402.4.5.2#1-EC-HICKMAN.doc

CE188 – 13
C402.4.5.2

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C402.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers. The dampers shall have ~~with~~ a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) and shall be labeled by an *approved agency* when tested in accordance with AMCA 500D for such purpose.

Reason: This change will make enforcement faster and easier. Applying sealed (low-leakage) dampers in the building envelope saves energy and is more easily enforced because of the presence of a certification label.

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

CE188-13

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

C402.4.5.2#2-EC-HICKMAN.doc

CE189 – 13
C402.4.5.2

Proponent: Amanda Hickman, InterCode Incorporation, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C402.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers with a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

Exceptions:

1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft2 (101.6 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:

   1.1. In buildings for exhaust and relief dampers.

   1.2. In buildings less than three stories in height above grade.

   1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.

   1.4. Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm (141 L/s).

   Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.

~~2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft2 (203.2 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

Reason: Exception #2 is unnecessary and probably confusing to some code users considering the charging statement. All damper manufacturers already make low-cost backdraft dampers that easily meet the leakage rate of 4 cfm/sq ft at 1 in. w.wg. as required in C402.4.5.2. This change will save energy while not increasing cost.

Cost Impact: The code change proposal will not increase the cost of construction.

CE189-13

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

C402.4.5.2#3-EC-HICKMAN.doc

CE190 – 13
C402.4.7

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

Revise as follows:

C402.4.7 Vestibules. All building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

<u>The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. Either the interior or exterior of unconditioned vestibules shall comply with building envelope requirements. The building lobby shall not be considered a vestibule.</u>

Exceptions:

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors that open directly from a<u>n</u> <u>atmospherically-separated</u> space less than 3,000 square feet (298 m^2) in area <u>that is not used as the entrance to areas of the building larger than 3000 square feet.</u>
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. <u>Building entrances in buildings that are less than four stories above grade and less than 10,000 square feet in area.</u>

Reason: This change clarifies the requirements for continuity of the building thermal envelope at vestibules (and that only the inner wall or the outer wall of the vestibule must comply). Exception 4 adds a phrase that is necessary to clarify that the exception does not apply to lobbies and similar building entrances. Exception 7 adds a new exception for very small buildings, because the vestibule could impose a disproportionate burden for them.

Cost Impact: The code change proposal will not increase the cost of construction.

CE190-13

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

C402.4.7-EC-KRANZ.doc

CE191 – 13
C402.4.7

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C402.4.7 Vestibules. All building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Exceptions:

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used regularly to gain access to the building ~~by the public~~, such as doors to mechanical or electrical equipment rooms, or doors intended solely for emergency egress ~~employee use~~.
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors ~~that open directly from a space~~ in buildings less than ~~3,000~~ 1,000 square feet (~~298~~ 100 m^2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, does not match the exceptions that are shown in the IECC. The current vestibule requirements are similar, but additional work has been done by SSPC 90.1. This change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will increase the cost of construction for buildings that now need vestibules that previously did not need them.

CE191-13

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

C402.4.7-EC-FERGUSON.doc

CE192 – 13
C202 (NEW), C402.4.7, Chapter 5

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C402.4.7 Vestibules. All building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Exceptions: Vestibules are not required for the following:

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m2) in area.
5. Revolving doors.
6. Doors that have an installed air curtain that has been tested in accordance with ANSI/AMCA 220. Air curtains shall be controlled with the opening and closing of the door.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

AIR CURTAIN. A device that generates and discharges a laminar air stream installed at the building entrance intended to prevent the infiltration of external, unconditioned air into the conditioned spaces, or the loss of interior, conditioned air to the outside.

Add new standard to Chapter 5 as follows:

AMCA

220-05 Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating.

Reason: This code change will allow an air curtain to be used as a low cost, low maintenance alternative to a vestibule, thereby saving valuable floor space and creating an invisible, energy saving barrier when the door is open. An air curtain's base function requires nothing more than ambient air. Air curtains can save from 1-10% of the building energy use, depending on climate zone, building size, wind exposure and traffic volume. On average, an air curtain saves 60 - 80% of the energy lost through an open unprotected doorway, while consuming as little as 7.5% of that energy to operate. They require minimal annual maintenance (such as cleaning or vacuuming) and have a life expectancy of 15 to 25 years.

Air curtains installed on the interior of a building provides a coherent sheet of air created by an air stream and the surrounding entrained air. This sheet of air is able to bend and resist thermal exchange over an opening by way of support from the building's interior pressure and the stability created as the air stream meets a return grill or splits when it meets a surface, such as a floor, or another air stream.

An additional benefit of using an air curtain is a cleaner environment. They prevent the infiltration of dirt, fumes and debris and repel flying insects. They are approved for use in the food service industry as a means of insect control for customer entry doors, kitchen service, and delivery doors. They also have less of a propensity to be unintentional defeated like a vestibule, by common situations such as high traffic or being held open for egress.

Numerous studies have been published that evaluate the effectiveness of air curtains. When compared to that of a vestibule, air curtains consistently outperform vestibules in energy savings. Recent studies take advantage of current technology to evaluate the air curtains efficiencies and effectiveness.

Cost Impact: The code change proposal will not increase the cost of construction. It will decrease the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AMCA 220-05 Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

Note: The term 'air curtain' is currently defined in the IgCC. The definition is the same as proposed here.

CE192-13

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

C402.4.7-EC-HICKMAN.doc

CE193 – 13
C402.4.8

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.8 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be: ~~sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be~~

1. IC-rated, ~~and~~
2. L~~l~~abeled as having an air leakage rate of not more than 2.0 cfm when tested in accordance with ASTM D E 283 at a 1.57 psf pressure differential, and~~. All recessed luminaires shall be s~~
3. Sealed with gasket or caulk between the housing and interior wall or ceiling covering.

Reason: The location in the building thermal envelope defines by default the reason for the requirement (i.e. to limit air leakage). This proposal clarifies the language for sealing recessed lighting that is located in the building thermal envelope. The current language could be interpreted to require gasketing or caulking recessed fixtures even when not installed in the thermal envelope, even though there is no reason for this requirement. The objective of this proposal is to clarify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal will not increase the cost of construction.

CE193-13

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

C402.4.8-EC-WILLIAMS.doc

CE194 – 13
C202 (NEW), C402.1, C402.5 (NEW), C403.1, C403.5 (NEW), C403.6, C405.1, C405.10 (NEW)

Proponent: Tim Nogler, Washington Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C402.5.

C402.5 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers. *Walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with all of the following:

1. Be equipped with automatic door closers that firmly close walk-in doors that have been closed to within 1 inch of full closure.

   Exception: Automatic closers are not required for doors wider than 3 feet 9 inches or taller than 7 feet.

2. Doorways shall have strip doors, curtains, spring-hinged doors, or other method of minimizing infiltration when doors are open.

3. *Walk-in coolers* and *refrigerated warehouse coolers* shall contain wall, ceiling, and door insulation of not less than R–25 and *walk-in freezers* and *refrigerated warehouse freezers* shall contain wall, ceiling, and door insulation of not less than R–32.

   Exception: Glazed portions of doors or structural members need not be insulated.

4. *Walk-in freezers* shall contain floor insulation of not less than R–28.

5. Transparent reach-in doors for *walk-in freezers* and windows in *walk-in freezer* doors shall be of triple-pane glass, either filled with inert gas or with heat-reflective treated glass.

6. Windows and transparent reach-in doors for *walk-in coolers* doors shall be of double-pane or triple-pane, inert gas-filled, heat-reflective treated glass.

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, or ventilating needs shall comply with Section C403.2 (referred to as the mandatory provisions) and either:

1. Section C403.3 (Simple systems); or
2. Section C403.4 (Complex systems).

Walk-in coolers, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with Section C403.5.

C403.5 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers. *Walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with all of the following:

1. Evaporator fan motors that are less than 1 horsepower and less than 460 volts shall use electronically commutated motors, brushless direct current motors, or 3-phase motors.

2. Condenser fan motors that are less than 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.
3. Where anti-sweat heaters without anti-sweat heater controls are provided, they shall have a total door rail, glass, and frame heater power draw of not more than 7.1 Watts per square foot of door opening for *walk-in freezers*, and 3.0 Watts per square foot of door opening for *walk-in coolers*.
4. Where anti-sweat heater controls are provided, they shall reduce the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, and minimum acceptable lighting equipment for exterior applications.

> **Exception:** Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that not less than 75 percent of the permanently installed light fixtures, other than low voltage lighting, shall be fitted for, and contain only, high efficacy lamps~~.~~. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C405.10.

C405.10 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers. Lights in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall either use light sources with an efficacy of not less than 40 lumens per Watt, including ballast losses , or shall use light sources with an efficacy of not less than 40 lumens per Watt, including ballast losses , in conjunction with a device that turns off the lights within 15 minutes when the space is not occupied.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

REFRIGERATED WAREHOUSE COOLER. An enclosed storage space capable of being refrigerated to temperatures above 32°F that can be walked into and has a total chilled storage area of not less than 3,000 square feet.

REFRIGERATED WAREHOUSE FREEZER: An enclosed storage space capable of being refrigerated to temperatures at or below 32°F that can be walked into and has a total chilled storage area of not less than 3,000 square feet.

WALK-IN COOLER. An enclosed storage space capable of being refrigerated to temperatures above 32°F that can be walked into and has a total chilled storage area of less than 3,000 square feet.

WALK-IN FREEZER: An enclosed storage space capable of being refrigerated to temperatures at or below 32°F that can be walked into and has a total chilled storage area of less than 3,000 square feet..

Reason: Refrigeration is one of the largest unregulated electrical loads in buildings. This proposal provides basic minimum performance levels for walk-in coolers and freezers, and for refrigerated warehouse coolers and refrigerated warehouse freezers. The national model code should set a minimum performance for these significant energy using systems. This proposal is based on industry standard practice.

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

CE194-13

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

C402.1-EC-NOGLER.doc

CE195 – 13

C403.1, C403.2, C403.2.3, Table C403.2.3(7), Table C403.2.3(8), Table C403.2.3(9), C403.2.3.1, C403.2.3.2, C403.2.4, C403.2.5.1, C403.2.10, C403.2.10.1, C403.2.10.2, Table C403.2.10.1(1), Table C403.2.10.1(2), C403.3, C403.3.2, C403.4 thru C403.4.6, C403.4.1.3, C403.4.7, C406.2, Table C406.2(6), Table C406.2(7), Chapter 5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.1 General. Mechanical systems and equipment serving all or a portion of the building heating, cooling or ventilating needs that are unitary or packaged in nature and serving a single *zone* and controlled by a single thermostat in the *zone* served, or are two-pipe heating only systems serving one or more *zones*, shall comply with Sections 403.2 (~~referred to as the~~ mandatory provisions) and ~~either:~~

~~1.~~ ~~Section~~ C403.3 (~~Simple systems~~ prescriptive provisions).~~; or~~

~~2.~~ ~~Section C403.4 (Complex systems~~ All other mechanical systems or equipment shall meet the provisions of Section 6 of *ANSI/ASHRAE/IES Standard 90.1*.

C403.2 **Mechanical systems and equipment** ~~**Provisions applicable to all mechanical systems**~~ **(Mandatory).** Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Sections C403.2.1 through C403.2.11.

C403.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.2.3(1), C403.2.3(2), C403.2.3(3), C403.2.3(4), C403.2.3(5)~~,~~ and C403.2.3(6)~~, C403.2.3(7) and C403.2.3(8)~~ when tested and rated in accordance with the applicable test procedure. ~~Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.2.3(9).~~ The efficiency shall be verified through certification under an *approved* certification program or, if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

~~TABLE C403.2.3(7)~~
~~MINIMUM EFFICIENCY REQUIREMENTS:~~
~~WATER CHILLING PACKAGES~~[a]

~~TABLE C403.2.3(8)~~
~~MINIMUM EFFICIENCY REQUIREMENTS:~~
~~HEAT REJECTION EQUIPMENT~~

~~TABLE C403.2.3(9)~~
~~HEAT TRANSFER EQUIPMENT~~

~~**C403.2.3.1 Water-cooled centrifugal chilling packages.** Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s · kW) condenser water flow shall have maximum full-load kW/ton and *NPLV* ratings adjusted using Equations 4-3 and 4-4.~~

~~Adjusted minimum full-load COP ratings =~~
~~(Full-load COP from Table 6.8.1C of AHRI~~

~~Standard 550/590) × K_{adj}~~

~~**(Equation 4-3)**~~

~~Adjusted minimum NPLV rating =~~
~~(IPLV from Table 6.8.1C of AHRI Standard 550/590) × K_{adj}~~

~~**(Equation 4-4)**~~

~~where:~~

~~K_{adj} = A × B~~

~~A = 0.0000015318 × $(LIFT)^4$ – 0.000202076 × $(LIFT)^3$ + 0.0101800 × $(LIFT)^2$ – 0.264958 × LIFT + 3.930196~~

~~B = 0.0027 × L_{vg}^{Evap} (°C) + 0.982~~

~~LIFT = L_{vg}^{Cond} – L_{vg}^{Evap}~~

~~L_{vg}^{Cond} = Full-load condenser leaving water temp-erature (°C)~~

~~L_{vg}^{Evap} = Full-load leaving evaporator temperature (°C)~~

~~SI units shall be used in the K_{adj} equation.~~

~~The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:~~

1. ~~The leaving evaporator fluid temperature is not less than 36°F (2.2°C).~~
2. ~~The leaving condenser fluid temperature is not greater than 115°F (46.1°C).~~
3. ~~LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C).~~

~~**Exception:** Centrifugal chillers designed to operate outside of these ranges need not comply with this code.~~

~~**C403.2.3.2 Positive displacement (air- and water-cooled) chilling packages.** Equipment with a leaving fluid temperature higher than 32°F (0°C), shall meet the requirements of Table C403.2.3(7) when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.~~

C403.2.4 HVAC system controls. Each heating and cooling system shall be provided with thermostatic controls as specified in Section C403.2.4.1, C403.2.4.2, C403.2.4.3~~,~~ and C403.2.4.4~~, C403.4.1, C403.4.2, C403.4.3 or C403.4.4~~.

C403.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) shall be provided for spaces larger than 500 square feet (50 m^2) and with an average occupant load of 25 people per 1000 square feet (93 m^2) of floor area (as established in Table 403.3 of the *International Mechanical Code*) and served by systems with one or more of the following:

1. An air-side economizer;
2. Automatic modulating control of the outdoor air damper; or
3. A design outdoor airflow greater than 3,000 cfm (1400 L/s).

Exception: Demand control ventilation is not required for systems and spaces as follows:

1. Systems with energy recovery complying with Section C403.2.6.
2. ~~Multiple-*zone* systems without direct digital control of individual *zones* communicating with a central control panel.~~
3. System with a design outdoor airflow less than 1,200 cfm (600 L/s).

4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (600 L/s).
5. Ventilation provided for process loads only.

C403.2.10 Air system design ~~and control~~. Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) ~~shall meet the provisions of Sections C403.2.10.1 through C403.2.10.2~~ at fan system design conditions shall ~~not exceed the allowable~~ have a maximum *fan system motor nameplate hp* of 0.0011 X CFMs, where CFMs is the maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute. ~~(Option 1) or *fan system bhp* (Option 2) as shown in Table C403.2.10.1(1).~~ This includes supply fans~~,~~ and return/relief fans~~, and fan-powered terminal units~~ associated with systems providing heating or cooling capability. ~~Single *zone* variable-air-volume systems shall comply with the constant volume fan power limitation.~~

Exception:

~~1.~~ ~~Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.~~

~~2.~~ Individual exhaust fans with motor nameplate horsepower of 1 hp or less.

~~**C403.2.10.1 Allowable fan floor horsepower.** Each HVAC system at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) as shown in Table C403.2.10.1(1). This includes supply fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single *zone* variable-air-volume systems shall comply with the constant volume fan power limitation.~~

~~**Exception:** The following fan systems are exempt from allowable fan floor horsepower requirement.~~

1. ~~Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.~~
2. ~~Individual exhaust fans with motor nameplate horsepower of 1 hp or less.~~

~~**C403.2.10.2 Motor nameplate horsepower.** For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower (bhp). The fan brake horsepower (bhp) shall be indicated on the design documents to allow for compliance verification by the *code official*.~~

~~**Exceptions:**~~

1. ~~For fans less than 6 bhp (4413 W), where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~
2. ~~For fans 6 bhp (4413 W) and larger, where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~

~~**TABLE C403.2.10.1(1)**~~
~~**FAN POWER LIMITATION**~~

~~**TABLE C403.2.10.1(2)**~~
~~**FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT**~~

~~**C403.3 Simple HVAC systems and equipment (Prescriptive).** This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8), each serving one *zone* and controlled by a single thermostat in the *zone* served. It also applies to two-pipe heating systems serving one or more *zones*, where no cooling system is installed.~~

C403.3 Mechanical systems and equipment (Prescriptive). Mechanical systems and equipment serving the building heating, cooling and ventilation needs shall comply with Sections C403.3.1 and C403.3.2.

C403.3.2 Hydronic systems ~~controls~~. Hydronic heating systems comprised of multiple-packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers and to automatically reduce flow through the boiler plant when another boiler is shut down. Hydronic heating systems comprised of a single boiler having an input design capacity over 500,000 Btu/h (146,550W) shall include either a multi-staging or modulating burner.

Hydronic systems of at least 300,000 Btu/h (87,930 W) design output capacity supplying heated ~~and chilled~~ water to comfort conditioning systems shall be designed for variable fluid flow with control valves designed to modulate or step down, and close, as a function of load and include controls that ~~meet the requirements of Sections C403.4.3~~:

1. Automatically reset the supply water temperatures using zone-return water temperature, building-return water temperature, zone loads, or outside air temperature as an indicator of building heating demand. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; and

2. Reduce system pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-stated pumps where at least one-half of the total pump horsepower is capable of being automatically turned off.

~~**C403.4.1.3**~~ **C403.3.1.1.5 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.
2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.

~~**C403.4 Complex HVAC systems and equipment. (Prescriptive).** This section applies to buildings served by HVAC equipment and systems not covered in Section C403.3.~~

~~**C403.4.1 Economizers.** Economizers shall comply with Sections C403.4.1.1 through C403.4.1.4.~~

~~**C403.4.1.1 Design capacity.** Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.~~
~~**Exception:** Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).~~

~~**C403.4.1.2 Maximum pressure drop.** Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (noneconomizer) mode.~~

~~**C403.4.1.3 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.~~

~~**Exceptions:**~~

1. ~~Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.~~
2. ~~Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.~~

~~**C403.4.1.4 Economizer heating system impact.** HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.~~

~~**Exception:** Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.~~

~~**C403.4.2 Variable air volume (VAV) fan control.** Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:~~

1. ~~Driven by a mechanical or electrical variable speed drive;~~
2. ~~Driven by a vane-axial fan with variable-pitch blades; or~~
3. ~~The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.~~

~~**C403.4.2.1 Static pressure sensor location**. Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2. For sensors installed down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.~~

~~**C403.4.2.2 Set points for direct digital control.** For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.~~

~~**C403.4.3 Hydronic systems controls.** The heating of fluids that have been previously mechanically cooled and the cooling of fluids that have been previously mechanically heated shall be limited in accordance with Sections C403.4.3.1 through C403.4.3.3. Hydronic heating systems comprised of multiple-packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers. Hydronic heating systems comprised of a single boiler and greater than 500,000 Btu/h (146 550 W) input design capacity shall include either a multistaged or modulating burner.~~

~~**C403.4.3.1 Three-pipe system.** Hydronic systems that use a common return system for both hot water and chilled water are prohibited.~~

~~**C403.4.3.2 Two-pipe changeover system.** Systems that use a common distribution system to supply both heated and chilled water shall be designed to allow a dead band between changeover from one mode to the other of at least 15°F (8.3°C) outside air temperatures; be designed to and provided with controls that will allow operation in one mode for at least 4 hours before changing over to the other mode; and be provided with controls that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F (16.7°C) apart.~~

~~**C403.4.3.3 Hydronic (water loop) heat pump systems**. Hydronic heat pump systems shall comply with Sections C403.4.3.3.1 through C403.4.3.3.3.~~

~~**C403.4.3.3.1 Temperature dead band.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (11.1°C) between initiation of heat rejection and heat addition by the central devices.~~

> ~~**Exception:** Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on realtime conditions of demand and capacity, dead bands of less than 20°F (11°C) shall be permitted.~~

~~**C403.4.3.3.2 Heat rejection.** Heat rejection equipment shall comply with Sections C403.4.3.3.2.1 and C403.4.3.3.2.2.~~

> ~~**Exception:** Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.~~

~~**C403.4.3.3.2.1 Climate Zones 3 and 4.** For Climate Zones 3 and 4:~~

1. ~~If a closed-circuit cooling tower is used directly in the heat pump loop, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided.~~
2. ~~If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.~~
3. ~~If an open- or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.~~

~~**C403.4.3.3.2.2 Climate Zones 5 through 8.** For Climate Zones 5 through 8, if an open- or closed-circuit cooling tower is used, then a separate heat exchanger shall be provided to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.~~

~~**C403.4.3.3.3 Two position valve.** Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.~~

~~**C403.4.3.4 Part load controls.** Hydronic systems greater than or equal to 300,000 Btu/h (87 930 W) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have the capability to:~~

1. ~~Automatically reset the supply-water temperatures using zone-return water temperature, building-return water temperature, or outside air temperature as an indicator of building heating or cooling demand. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; or~~
2. ~~Reduce system pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or control valves designed to modulate or step down, and close, as a function of load, or other *approved* means.~~

~~**C403.4.3.5 Pump isolation.** Chilled water plants including more than one chiller shall have the capability to reduce flow automatically through the chiller plant when a chiller is shut down. Chillers piped in series for the purpose of increased temperature differential shall be considered as one chiller.~~

~~Boiler plants including more than one boiler shall have the capability to reduce flow automatically through the boiler plant when a boiler is shut down.~~

~~**C403.4.4 Heat rejection equipment fan speed control.** Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.~~

~~**Exception:** Factory-installed heat rejection devices within HVAC equipment tested and rated in accordance with Tables C403.2.3(6) and C403.2.3(7).~~

~~**C403.4.5 Requirements for complex mechanical systems serving multiple zones.** Sections C403.4.5.1 through C403.4.5.4 shall apply to complex mechanical systems serving multiple zones. Supply air systems serving multiple zones shall be VAV systems which, during periods of occupancy, are designed and capable of being controlled to reduce primary air supply to each *zone* to one of the following before reheating, recooling or mixing takes place:~~

1. ~~Thirty percent of the maximum supply air to each *zone*.~~
2. ~~Three hundred cfm (142 L/s) or less where the maximum flow rate is less than 10 percent of the total fan system supply airflow rate.~~
3. ~~The minimum ventilation requirements of Chapter 4 of the *International Mechanical Code.*~~

~~**Exception:** The following define where individual *zones* or where entire air distribution systems are exempted from the requirement for VAV control:~~

1. ~~*Zone*s where special pressurization relationships or cross-contamination requirements are such that VAV systems are impractical.~~
2. ~~*Zones* or supply air systems where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.~~
3. ~~*Zones* where special humidity levels are required to satisfy process needs.~~
4. ~~*Zones* with a peak supply air quantity of 300 cfm (142 L/s) or less and where the flow rate is less than 10 percent of the total fan system supply airflow rate.~~
5. ~~*Zones* where the volume of air to be reheated, recooled or mixed is no greater than the volume of outside air required to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.~~
6. ~~*Zones* or supply air systems with thermostatic and humidistatic controls capable of operating in sequence the supply of heating and cooling energy to the *zones* and which are capable of preventing reheating, recooling, mixing or simultaneous supply of air that has been previously cooled, either mechanically or through the use of economizer systems, and air that has been previously mechanically heated.~~

~~**C403.4.5.1 Single duct variable air volume (VAV) systems, terminal devices.** Single duct VAV systems shall use terminal devices capable of reducing the supply of primary supply air before reheating or recooling takes place.~~

~~**C403.4.5.2 Dual duct and mixing VAV systems, terminal devices.** Systems that have one warm air duct and one cool air duct shall use terminal devices which are capable of reducing the flow from one duct to a minimum before mixing of air from the other duct takes place.~~

~~**C403.4.5.3 Single fan dual duct and mixing VAV systems, economizers.** Individual dual duct or mixing heating and cooling systems with a single fan and with total capacities greater than 90,000 Btu/h [(26 375 W) 7.5 tons] shall not be equipped with air economizers.~~

~~**C403.4.5.4 Supply-air temperature reset controls.** Multiple *zone* HVAC systems shall include controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls shall be capable of resetting the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.~~

~~**Exceptions:**~~

1. ~~Systems that prevent reheating, recooling or mixing of heated and cooled supply air.~~
2. ~~Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.~~
3. ~~Zones with peak supply air quantities of 300 cfm (142 L/s) or less.~~

~~**C403.4.6 Heat recovery for service water heating.** Condenser heat recovery shall be installed for heating or reheating of service hot water provided the facility operates 24 hours a day, the total installed heat capacity of water-cooled systems exceeds 6,000,000 Btu/hr (1 758 600 W) of heat rejection, and the design service water heating load exceeds 1,000,000 Btu/h (293 100 W).~~

~~The required heat recovery system shall have the capacity to provide the smaller of:~~

1. ~~Sixty percent of the peak heat rejection load at design conditions; or~~
2. ~~The preheating required to raise the peak service hot water draw to 85°F (29°C).~~

~~**Exceptions:**~~

1. ~~Facilities that employ condenser heat recovery for space heating or reheat purposes with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.~~
2. ~~Facilities that provide 60 percent of their service water heating from site solar or site recovered energy or from other sources.~~

~~C403.4.7~~ <u>C403.3.2</u> Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated in Table C403.4.7

Exception: Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (26 379 W).

TABLE ~~C403.4.7~~ <u>C403.3.2</u>
MAXIMUM HOT GAS BYPASS CAPACITY

RATED CAPACITY	MAXIMUM HOT GAS BYPASS CAPACITY (% of total capacity)
≤ 240,000 Btu/h	50
> 240,000 Btu/h	25

For SI: 1 British thermal unit per hour = 0.2931 W.

C406.2 Efficient HVAC performance<u>. For systems required by Sections 403.1 to meet provisions of Sections C403.2 (mandatory provisions) and C403.3 (prescriptive provisions)</u>, equipment shall meet the minimum efficiency requirements of Tables C406.2.(1) through C406.2(~~7~~ <u>5</u>) in addition to the requirements in Section C403. This section shall only be used where the equipment efficiencies in Tables C406.2(1) through C406.2(~~7~~ <u>5</u>) are greater than the equipment efficiencies listed in Table C403.2.3(1) through 403.2.3(~~7~~ <u>6</u>) for the equipment type.

<u>For systems required by Sections 403.1 to meet provisions of Section 6 of *ANSI/ASHRAE/IES Standard 90.1* heating and cooling equipment shall have a rated efficiency 10% greater than required by Section 6 of *ANSI/ASHRAE/IES Standard 90.1*.</u>

~~TABLE C406.2(6)~~
~~CHILLERS—EFFICIENCY REQUIREMENTS~~

~~TABLE C406.2(7)~~
~~ABSORPTION CHILLERS—EFFICIENCY REQUIREMENTS~~

Delete standard from Chapter 5 as follows:

AHRI

~~400—01 Liquid to Liquid Heat Exchangers with Addendum 2~~
~~550/590—03 Water Chilling Packages Using the Vapor Compression Cycle—with Addenda~~
~~560—00 Absorption Water Chilling and Water-heating Packages~~

~~**CTI** Cooling Technology Institute~~
~~2611 FM 1960 West, Suite A-101~~
~~Houston, TX 77068~~

~~ATC 105 (00)~~	~~Acceptance Test Code for Water Cooling Tower~~
~~STD 201—09~~	~~Standard for Certification of Water Cooling Towers Thermal Performances~~

Reason: The code change retains all the provisions of Section C403 of the 2012 IECC as applicable to simple HVAC systems and equipment as currently defined in the IECC, with some minor modifications for hydronic systems. Note that a significant majority of the commercial buildings constructed in the United States are on the order of 20,000 square feet or less in floor area and would likely be covered by these resultant provisions for simple systems and equipment.

The provisions for complex (e.g. non-simple) HVAC systems are updated and maintained by ASHRAE on a regular and ongoing basis. It seems duplicative and time consuming to try and keep the provisions of the IECC for such equipment and systems consistent with Standard 90.1, when so much effort is spent in SSPC 90.1 updating and maintaining these provisions. A review of the past few code development cycles finds very few changes were submitted to the provisions for complex systems other than to keep the IECC consistent with the provisions in Standard 90.1.

While there may be an advantage in having the provisions for complex systems provided directly in the IECC to foster their availability, such complex systems will have a registered design professional or engineer involved in the design and construction who should be providing sealed plans and specifications. Given the recent emphasis on the availability of resources for state and local code compliance verification efforts it seems reasonable to rely on Standard 90.1 for the criteria for such systems and equipment and the engineers and design professionals that would be involved in their implementation and compliance verification via their professional credentials.

An important note is that this is not a return to the prior “mix and match” approach of allowing developers to meet one section (e.g., envelope) in the IECC and another (say lighting) in ASHRAE 90.1. This is a clear referral and not an optional choice. Simple HVAC system provisions are in the IECC and the complex system requirements in ASHRAE 90.1 are included by reference. There is always the option of using ASHRAE 90.1 for the entire compliance path under section 401.2 or 401.2.1, but in either case, complex HVAC systems would be subject to requirements in ASHRAE 90.1.

This change will greatly simplify the code and as noted above continue to provide criteria for more complex systems through a singular process. Details to foster an understanding of this code change are provided below and correspond to each of the ten specific actions needed to implement this change and further simplify the provisions in the ICC for HVAC systems and equipment.

1. The proposed changes to C403.1 are intended to bring forward the scope of C403.3 for simple systems to the beginning of C403 to provide the necessary outline and structure for the resultant C403. Section C403.1 now clearly indicates what is covered by the building mechanical system provisions, what constitutes a simple HVAC system and equipment, and that such systems and equipment would need to comply with the provisions of the IECC and those that are not would now be required to comply with ANSI/ASHRAE/IES Standard 90.1 as currently referenced in the IECC. This eliminates the need to maintain separate and parallel provisions for other than simple systems in the IECC that are maintained in Standard 90.1.
2. The title of C403.2 requires revision to ensure the correct organization of the provisions of C403. Section C403.1 now establishes the scope of the provisions for simple HVAC systems and equipment. The sections after C403.1 apply to mechanical systems and equipment and are either mandatory (C403.2) or prescriptive (C403.3). If HVAC systems and equipment are not simple, as defined in C403.1, then the provisions of Standard 90.1 apply.
3. The scope of C403 as simple HVAC systems and equipment covering only unitary or packaged cooling equipment eliminates the relevance of Tables C403.2.3(7), and C403.2.3(8) which apply to equipment associated with complex systems as defined in the IECC now (e.g. non-simple). These same provisions are provided in Standard 90.1 and need not be provided here. By referencing Standard 90.1, it is unnecessary for IECC to undergo several code changes in order to keep the code consistent with Standard 90.1.
4. Sections C403.2.3.1 and C403.2.3.2 apply to water chilling packages that are associated with systems other than those covered by Section C403 pursuant to this change (e.g. non-simple systems that are now covered by Standard 90.1).

5. Sections C403.4.1 through C403.4.4 are deleted through this code change as discussed above and no longer need to be referenced. The provisions of C403.2.4.1 through C403.2.4.4 apply to simple HVAC systems and equipment and should be retained as currently presented.
6. Exception 2 to C403.2.5.1 would not be applicable to the scope of C403 as proposed herein (simple systems) because simple HVAC systems and equipment are limited to serving a singular zone and this exception applies to multiple zone systems.
7. In now applying to simple systems the provisions in C403.2.10.1 for fan system brake horsepower are no longer applicable and would be addressed in Standard 90.1. Table C403.2.10.1(1) can be deleted as the one remaining set of provisions is better presented in a textual rather than tabular form. Table C403.2.10.1(2) is deleted as it is only applicable to the brake horsepower path which is no longer present for the simplified path. What remains is a set of provisions for air system fan horsepower that can be stated in a singular section through modification to C403.2.10. The title of C403.2.10 is revised so it does not contain now nor would it contain any provisions on air system control.
8. With the movement of the current provisions of C403.3 to C403.1 to address the scope of C403 at the beginning of the section, the current performance provisions in C403.3 for simple systems need an appropriate introductory section.
9. The current hydronic system control provisions in Section C403.3.2 are modified for consistency with the scope of the proposed Section C403 and do not apply to chilled water systems. In addition, Section C403.4 would be deleted in deference to Standard 90.1 for complex (e.g. non-simple) HVAC systems and equipment as discussed above. The controls provisions now in Section C403.4 are brought forward as applicable to simple HVAC systems and equipment. The provisions applicable to hydronic systems covered by the new Section C403.3 (heating only systems) are Sections C403.4.3.4 and the second paragraph of Section C403.4.3.5, both of which are included in the code change above as new text to Section C403.3.2 on hydronic systems. There are minor modifications to improve pumping efficiency by requiring variable flow on smaller systems without variable speed drives being required.
10. The economizer integration requirements are currently located in C403.4.1.3 for complex systems and are applicable to simple systems as defined pursuant to this code change. As a consequence they need to be retained in the IECC and are proposed to be moved so they are retained for simple systems.
11. Unneeded complex system sections and tables are deleted. ASHRAE 90.1 becomes the reference for these systems.
12. Hot gas bypass restrictions are retained, as they apply to some larger simple systems.
13. The HVAC option in C406.2 needs to be adjusted to accommodate the reference to Standard 90.1 for complex systems. As proposed, Section C403 provides specific criteria within the IECC for simple mechanical systems and then defers to Standard 90.1 for complex systems in lieu of providing specific criteria within the IECC for complex systems. The provisions of C406.2 as written would and should continue to be applied over and above the specific criteria within the IECC. In now referencing Standard 90.1 for complex systems, a parallel option must also exist for those buildings that would comply using the specific criteria within the IECC but in the case of mechanical systems would defer to Standard 90.1.
14. High efficiency chiller tables are no longer required, as the high efficiency chiller option is indexed to ASHRAE 90.1.
15. Several reference standards are no longer required.

Any cost impact would be attributable to the loss of the provisions in Section C403.4 for complex HVAC systems and the impact of requiring compliance with ANSI/ASHRAE/IES Standard 90.1 alone on any particular system design. A comparison of the provisions in Section C403.4 and Standard 90.1 would have to be conducted and applied to each design to determine if there are any specific increases or decreases in first cost and life cycle costs. There should be little cost difference between the current complex provisions and the 90.1 complex provisions if the trend for ASHRAE 90.1 proposals to be incorporated into IECC continues. ASHRAE 90.1 proposals typically go through a cost effectiveness vetting as they are released for public comment and incorporation into standard 90.1, so any differences with increased cost would be cost effective.

Cost Impact: There is no significant impact on construction cost.

CE195-13

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

C403.1-EC-WILLIAMS.doc

CE196 – 13
C403.2.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.1 Calculation of heating and cooling loads. Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with ~~the procedures described in~~ ANSI/AHRAE/ACCA Standard 183 or by an *approved* equivalent computational procedure using the design parameters specified in Chapter 3~~. The design loads shall account for the building envelope, lighting, ventilation and occupancy loads based on the project design.~~ Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE HVAC Systems and Equipment Handbook~~.~~ ~~Alternatively, design loads shall be determined by an approved equivalent computational procedure using the design parameters specified in Chapter 3~~.

Reason: ASHRAE 183 provides the relevant details on how to calculate the loads. The "loads" are specified as associated with HVAC. This proposal simplifies the language requiring heating and cooling load calculations to simply reference ASHRAE 183. The objective of this proposal is to simplify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal will not increase the cost of construction.

CE196-13

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

C403.2.1-EC-WILLIAMS.doc

CE197 – 13
C403.2.1

Proponent: Richard J. Davis, The Evergreen State College, Kevin Folsom, Dallas Theological Institute, representing APPA, Leadership in Education Facilities, Standards and Codes Council.

Revise as follows:

C403.2.1 Calculation of heating and cooling loads. Design loads shall be determined in accordance with the procedures described in ANSI/ASHRAE/ACCA Standard 183. The design loads shall account for occupant movement, the comfort for those moving between spaces, the building envelope, lighting, ventilation and occupancy loads based on the project design. Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the *ASHRAE HVAC Systems and Equipment Handbook.* Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3.

Reason: When older buildings or portions of buildings have different interior temperatures from new buildings or spaces, facility managers must address the perception that there is something wrong with the newer facility. Widely differing temperature classroom and public space set- points are not acceptable to our students and faculty.

Cost Impact: Unknown. Site specific.

CE197-13

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

C403.2.1-EC-DAVIS.doc

CE198 – 13
C403.2.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.2 Equipment ~~and system~~ sizing. The output capacity of heating and cooling equipment ~~and systems~~ shall not exceed the loads calculated in accordance with Section C403.2.1. A single piece of equipment providing both heating and cooling shall satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

Exceptions:

1. Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
2. Multiple units of the same equipment type with combined capacities exceeding the design load and provided with controls that have the capability to sequence the operation of each unit based on load.

Reason: This proposal clarifies intent that the provisions are written to apply to the output capacity of the equipment that provides heating or cooling functions.

While not defined, there is a distinct difference between systems and equipment. The equipment refers to the piece of equipment (or the appliance) that converts delivered energy into heating or cooling capability. The system is much broader in scope and includes not only the equipment but the distribution system, controls, etc. The design loads in Section C403.2.1 will cover the distribution system loads such that the loads in question and the point of comparison with size occurs at the output to the equipment.

Cost Impact: The code change proposal will not increase the cost of construction.

CE198-13

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

C403.2.2-EC-WILLIAMS.doc

CE199 – 13

Table C403.2.3(1), Table C403.2.3(3), Table C403.2.3(7)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C403.2.3(1)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency		Test Procedure[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~	
Air Conditioners, air Cooled	<65,000 Btu/h[b]	All	Split System	~~13.0 SEER~~	13.0 SEER	AHRI 210/240
			Single Package	~~13.0 SEER~~	13.0 SEER	
Through-the-wall (air cooled)	≤30,000 Btu/h[b]	All	Split system	~~12.0 SEER~~	12.0 SEER	
			Single Package	~~12.0 SEER~~	12.0 SEER	
Small-duct high-velocity (air cooled)	<65,000 Btu/h[b]	All	Split System	~~10.0 SEER~~	10.0 SEER	
Air conditioners, air cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.2 EER~~ ~~11.4 IEER~~	11.2 EER 11.4 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	10.8 EER 11.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~10.0 EER~~ ~~10.1 IEER~~	10.0 EER 10.1 IEER	
		All other	Split System and Single Package	~~9.8 EER~~ ~~9.9 IEER~~	9.8 EER 9.9 IEER	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~9.7 EER~~ ~~9.8 IEER~~	9.7 EER 9.8 IEER	
		All other	Split System and Single Package	~~9.5 EER~~ ~~9.6 IEER~~	9.5 EER 9.6 IEER	
Air Conditioners, water Cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.5 EER 12.7 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	12.3 EER 12.5 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.4 EER 12.6 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.2 EER 12.4 IEER	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.0 EER 12.4 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.0 EER 12.2 IEER	
Air Conditioners, evaporatively cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	AHRI 210/240

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency		Test Procedure[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.0 EER 12.2 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	11.8 EER 12.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	11.9 EER 12.1 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.2 EER 11.9 IEER	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~10.0 EER~~ ~~11.1 IEER~~	11.7 EER 11.9 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	11.5 EER 11.7 IEER	
Condensing units air cooled	≥135,000Btu/h			~~10.1 EER~~ ~~11.4 IEER~~	10.5 EER 14.0 IEER	AHRI 365
Condensing units water cooled	≥135,000Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	
Condensing units evaporatively cooled	≥135,000Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	

(Portions of Table not shown remain unchanged)

TABLE C403.2.3(3)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS,
PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS,
SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency		Test procedure[a]
			~~Before 10/08/2012~~	~~As of 10/08/2012~~	
PTAC (cooling mode) New Construction	All Capacities	95 F db outdoor air	~~12.5 - (0.213 x Cap/1000) EER~~	13.8 - (0.300 x Cap/1000) EER	AHRI 310/380
PTAC (cooling mode) replacements[b]	All Capacities	95 F db outdoor air	~~10.9 - (0.213 x Cap/1000) EER~~	10.9 - (0.213 x Cap/1000) EER	
PTHP (cooling mode) New Construction	All Capacities	95 F db outdoor air	~~12.3 - (0.213 x Cap/1000) EER~~	14.0 - (0.300 x Cap/1000) EER	
PTHP (cooling mode) replacements[b]	All Capacities	95 F db outdoor air	~~10.8 - (0.213 x Cap/1000) EER~~	10.8 - (0.213 x Cap/1000) EER	
PTHP (heating mode) new construction	All Capacities		~~3.2 - (0.26 x Cap/1000) COP~~	3.2 - (0.26 x Cap/1000) COP	
PTHP (heating mode) replacements[b]	All Capacities		~~2.9 - (0.26 x Cap/1000) COP~~	2.9 - (0.26 x Cap/1000) COP	
SPVAC (cooling mode)	<65,000 Btu/h	95 F db/ 75 F wb outdoor air	~~9.0 EER~~	9.0 EER	AHRI 390
	≥65,000 Btu/h and <135,000 Btu/h	95 F db/ 75 F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	95 F db/ 75 F wb outdoor air	~~8.6 EER~~	8.6 EER	
SPVHP (cooling mode)	<65,000 Btu/h	95 F db/ 75 F wb outdoor air	~~9.0 EER~~	9.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	95 F db/ 75 F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥135,000 Btu/h and <240,000	95 F db/ 75 F wb outdoor air	~~8.6 EER~~	8.6 EER	

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency		Test procedure[a]
			~~Before 10/08/2012~~	~~As of 10/08/2012~~	
	Btu/h				
SPVHP (heating mode)	<65,000 Btu/h	47 F db/ 43 F wb outdoor air	~~3.0 COP~~	3.0 COP	
	≥65,000 Btu/h and <135,000 Btu/h	47 F db/ 43 F wb outdoor air	~~3.0 COP~~	3.0 COP	
	≥135,000 Btu/h and <240,000 Btu/h	47 F db/ 75 F wb outdoor air	~~2.9 COP~~	2.9 COP	
Room air conditioners, with louvered slides	<6,000 Btu/h	--	~~9.7 SEER~~	9.7 SEER	ANSI/AHAM RAC-1
	≥6,000 Btu/h and <8,000 Btu/h	--	~~9.7 EER~~	9.7 EER	
	≥8,000 Btu/h and <14,000 Btu/h	--	~~9.8 EER~~	9.8 EER	
	≥14,000 Btu/h and <20,000 Btu/h		~~9.7 SEER~~	9.7 SEER	
	≥20,000 Btu/h		~~8.5 EER~~	8.5 EER	
Room air conditioners, with louvered slides	<8,000 Btu/h		~~9.0 EER~~	9.0 EER	
	≥8,000 Btu/h and <20,000 Btu/h		~~8.5 EER~~	8.5 EER	
	≥20,000 Btu/h		~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps with louvered sides	<20,000 Btu/h		~~9.0 EER~~	9.0 EER	
	≥20,000 Btu/h		~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps without louvered sides	<14,000 Btu/h		~~8.5 EER~~	8.5 EER	
	≥14,000 Btu/h		~~8.0 EER~~	8.0 EER	
Room air conditioner casement only	All capacities		~~8.7 EER~~	8.7 EER	
Room air conditioner casement-slider	All capacities		~~9.5 EER~~	9.5 EER	

(Portions of Table not shown remain unchanged)

TABLE 503.2.3(7)
MINIMUM EFFICIENCY REQUIREMENTS:
WATER CHILLING PACKAGES[a]

EQUIPMENT TYPE	SIZE CATEGORY	UNITS	~~BEFORE 1/1/2010~~		~~AS OF 1/1/2010[b]~~				TEST PROCEDURE
					PATH A		PATH B		
			~~FULL LOAD~~	~~IPLV~~	FULL LOAD	IPLV	FULL LOAD	IPLV	
Air-cooled chillers	<150 tons	EER	~~≥ 9.562~~	~~≥ 10.4 16~~	≥ 9.562	≥ 12.500	NA	NA	AHRI 550/590
	≥ 150 tons	EER			≥ 9.562	≥ 12.750	NA	NA	
Air cooled without condenser, electrical operated	All capacities	EER	~~≥ 10.586~~	~~≥ 11.782~~	Air-cooled chillers without condensers shall be rated with matching condensers and comply with the air-cooled chiller efficiency requirements				
Water cooled, electrically operated, reciprocating	All capacities	kW/ton	~~≤ 0.837~~	~~≤ 0.696~~	Reciprocating units shall comply with water cooled positive displacement efficiency requirements				
Water cooled, electrically operated, positive displacement	<75 tons	kW/ton	~~≤ 0.790~~	~~≤ 0.676~~	≤ 0.780	≤ 0.630	≤ 0.800	≤ 0.600	
	≥ 75 tons and <150 tons	kW/ton			≤0.775	≤0.615	≤0.790	≤0.586	
	≥ 150 tons and <300 tons	kW/ton	~~≤0.717~~	~~≤0.627~~	≤0.680	≤0.580	≤0.718	≤0.540	
	≥ 300 tons	kW/ton	~~≤ 0.639~~	~~≤ 0.571~~	≤ 0.620	≤ 0.540	≤ 0.639	≤ 0.490	
Water cooled, electrically operated, centrifugal	<150 tons	kW/ton	~~≤ 0.703~~	~~≤ 0.669~~	≤0.634	≤0.596	≤0.639	≤0.450	
	≥ 150 tons and <300 tons	kW/ton	~~≤ 0.634~~	~~≤ 0.596~~					
	≥ 300 tons and <600 tons	kW/ton	~~≤ 0.576~~	~~≤ 0.549~~	≤ 0.576	≤ 0.549	≤ 0.600	≤ 0.400	
	≥ 600 tons	kW/ton	~~≤ 0.576~~	~~≤ 0.549~~	≤ 0.570	≤ 0.539	≤ 0.590	≤ 0.400	
Air cooled, absorption single effect	All capacities	COP	~~≥ 0.600~~	~~NR~~	≥ 0.600	NR	NA	NA	AHRI 560
Water-cooled, absorption single effect	All capacities	COP	~~≥ 0.700~~	~~NR~~	≥ 0.700	NR	NA	NA	
Absorption double effect, indirect-fired	All capacities	COP	~~≥ 1.000~~	~~≥ 1.050~~	≥ 1.000	≥ 1.050	NA	NA	
Absorption double effect, direct fired	All capacities	COP	~~≥ 1.000~~	~~≥ 1.000~~	≥ 1.000	≥ 1.000	NA	NA	

(Portions of Table not shown remain unchanged)

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The requirements in these three columns would not be applicable to any new building designed and constructed under the 2015 IECC.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE199-13

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

C403.2.3(1)T-EC-THOMPSON-SEHPCAC

CE200 – 13

Table C403.2.3(1), Table C403.2.3(2), Table C403.2.3(3), Table C403.2.3(8), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.3(1)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
Air conditioners, air cooled	< 65,000 Btu/h[b]	All	Split System	~~13.0 SEER~~	13.0 SEER	13.0 SEER	AHRI 210/240
			Single Package	~~13.0 SEER~~	~~13.0~~ 14.0 SEER	14.0 SEER	
Through-the-wall (air cooled)	≤ 30,000 Btu/h[b]	All	Split system	~~12.0 SEER~~	12.0 SEER	12.0 SEER	
			Single Package	~~12.0 SEER~~	12.0 SEER	12.0 SEER	
Small-duct high-velocity (air cooled)	< 65,000 Btu/h[b]	All	Split System	~~10.0 SEER~~	~~10.0~~ 11.0 SEER	11.0 SEER	
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.2 EER~~ ~~11.4 IEER~~	11.2 EER 11.4 IEER	11.2 EER 12.8 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	11.0 EER 12.6 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	11.0 EER 12.4 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	10.8 EER 11.0 IEER	10.8 EER 12.2 IEER	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~10.0 EER~~ ~~10.1 IEER~~	10.0 EER 10.1 IEER	10.0 EER 11.6 IEER	
		All other	Split System and Single Package	~~9.8 EER~~ ~~9.9 IEER~~	9.8 EER 9.9 IEER	9.8 EER 11.4 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~9.7 EER~~ ~~9.8 IEER~~	9.7 EER 9.8 IEER	9.7 EER 11.2 IEER	
		All other	Split System and Single Package	~~9.5 EER~~ ~~9.6 IEER~~	9.5 EER 9.6 IEER	9.5 EER 11.0 IEER	
Air conditioners, water cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 210/240

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	12.1 EER 13.9 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	11.9 EER 13.7 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.5 EER 12.5 IEER	12.5 EER 13.9 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	12.3 EER 12.5 IEER	12.3 EER 13.7 IEER	
	≥ 240,000 Btu/h And < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.4 EER 12.6 IEER	12.4 EER 13.6 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.2 EER 12.4 IEER	12.2 EER 13.4 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.2 EER 12.4 IEER	12.2 EER 13.5 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.0 EER 12.2 IEER	12.0 EER 13.3 IEER	
Air conditioners, evaporatively cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	11.9 EER 12.1 IEER	
	< 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.0 EER 12.2 IEER	12.0 EER 12.2 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	11.8 EER 12.0 IEER	11.8 EER 12.0 IEER	
	< 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 ERR~~ ~~11.1 ERR~~	11.9 ERR 12.1 IERR	11.9 ERR 12.1 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 EER~~	~~12.2~~ 11.7 ERR 11.9 IEER	11.7 ERR 11.9 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 ERR~~ ~~11.1 EER~~	11.7 ERR 11.9 ERR	11.7 ERR 11.9 ERRT	
		All other	Split System and Single Package	~~10.8 ERR~~ ~~10.9 ERR~~	11.5 ERR 11.7 ERR	11.5 ERR 11.7 ERR	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
Condensing units, air cooled	≥ 135,000 Btu/h			~~10.1 EER~~ ~~11.4 IEER~~	10.5 EER ~~14.0~~ 11.8 IEER	10.5 EER 11.8 IEER	AHRI 365
Condensing units, water cooled	≥ 135,000 Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	13.5 EER 14.0 IEER	
Condensing units, evaporatively cooled	≥ 135,000 Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	13.5 EER 14.0 IEER	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.

b. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE C403.2.3(2)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
Air cooled (cooling mode)	< 65,000 Btu/h[b]	All	Split System	~~13.0~~ 14.0 SEER	14.0 SEER	AHRI 210/240
			Single Packaged	~~13.0~~ 14.0 SEER	14.0 SEER	
Through-the-wall, air cooled	≤ 30,000 Btu/h[b]	All	Split System	~~13.0~~ 12.0 SEER	12.0 SEER	
			Single Packaged	~~13.0~~ 12.0 SEER	12.0 SEER	
Single-duct high-velocity air cooled	< 65,000 Btu/h[b]	All	Split System	~~10.0~~ 11.0 SEER	11 SEER	
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	11.0 EER 12.0 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	10.8 EER 11.8 IEER	
	≥ 135,000 Btu/h and	Electric Resistance (or None)	Split System and Single Package	10.6 EER 10.7 IEER	10.6 EER 11.6 IEER	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
	< 240,000 Btu/h	All other	Split System and Single Package	10.4 EER 10.5 IEER	10.4 EER 11.4 IEER	
	≥ 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 9.6 IEER	9.5 EER 10.6 IEER	
		All other	Split System and Single Package	9.3 EER 9.4 IEER	9.3 EER 10.4 IEER	
~~Water source (cooling mode)~~	~~< 17,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~11.2 EER~~		~~ISO 13256-1~~
	~~≥ 17,000 Btu/h and < 65,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.0 EER~~		
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.0 EER~~		
~~Ground water source (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~16.2 EER~~		
		~~All~~	~~77°F entering water~~	~~13.4 EER~~		
~~Water-source water to water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~10.6 EER~~		~~ISO 13256-2~~
			~~59°F entering water~~	~~16.3 EER~~		
~~Ground water source Brine to water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering fluid~~	~~12.1 EER~~		
~~Air cooled (heating mode)~~	~~< 65,000 Btu/h[b]~~	—	~~Split System~~	~~7.7 HSPF~~		~~AHRI 210/240~~
		—	~~Single Package~~	~~7.7 HSPF~~		
~~Through-the-wall, (air cooled, heating mode)~~	~~≤ 30,000 Btu/h[b] (cooling capacity)~~	—	~~Split System~~	~~7.4 HSPF~~		

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
		—	~~Single Package~~	~~7.4 HSPF~~		
~~Small-duct high velocity (air cooled, heating mode)~~	~~< 65,000 Btu/h[b]~~	—	~~Split System~~	~~6.8 HSPF~~		
~~Air cooled (heating mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~	—	~~47ºF db/43ºF wb Outdoor Air~~	~~3.3 COP~~		~~AHRI 340/360~~
			~~17ºF db/15ºF wb Outdoor Air~~	~~2.25 COP~~		
	~~≥ 135,000 Btu/h (cooling capacity)~~	—	~~47ºF db/43ºF wb Outdoor Air~~	~~3.2 COP~~		
			~~17ºF db/15ºF wb Outdoor Air~~	~~2.05 COP~~		
~~Water source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~4.2 COP~~		~~ISO 13256-1~~
~~Ground water source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.6 COP~~		
~~Ground source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~3.1 COP~~		
~~Water-source water to water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~3.7 COP~~		~~ISO 13256-2~~
		—	~~50°F entering water~~	~~3.1 COP~~		
~~Ground source brine to water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~2.5 COP~~		
Water to Air: Water Loop (cooling mode)	<17,000 Btu/h	All	86 °F entering water	12.2 EER	12.2 EER	ISO 13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86 °F entering water	13 EER	13 EER	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
	≥65,000 Btu/h and <135,000 Btu/h	All	86 °F entering water	13 EER	13 EER	
Water to Air: Ground Water (cooling mode)	<135,000 Btu/h	All	59 °F entering water	18.0 EER	18.0 EER	ISO 13256-1
Brine to Air: Ground Loop (cooling mode)	<135,000 Btu/h	All	77 F entering water	14.1 EER	14.1 EER	ISO 13256-1
Water to Water: Water Loop (cooling mode)	<135,000 Btu/h	All	86 °F entering water	10.6 EER	10.6 EER	ISO-13256-2
Water to Water: Ground Water (Cooling Mode)	<135,000 Btu/h	All	59 °F entering water	16.3 EER	16.3 EER	
Brine to Water: Ground Loop (cooling mode)	<135,000 Btu/h	All	77 °F entering water	12.1 EER	12.1 EER	
Air cooled (heating mode)	<65,000 Btu/h[b]	—	Split System	8.2 HSPF	8.2 HSPF	AHRI 210/240
		—	Single Package	8.0 HSPF	8.0 HSPF	
Through-the-wall, (air cooled, heating mode)	≤30,000 Btu/h[b] (cooling capacity)	—	Split System	7.4 HSPF	7.4 HSPF	
		—	Single Package	7.4 HSPF	7.4 HSPF	
Small-Duct high velocity (air cooled, heating mode)	<65,000 Btu/h[b]	—	Split System	6.8 HSPF	6.8 HSPF	
Air Cooled (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	—	47ºF db/43ºF wb Outdoor Air	3.3 COP	3.3 COP	AHRI 340/360
			17ºF db/15ºF wb Outdoor Air	2.25 COP	2.25 COP	
	≥135,000 Btu/h (Cooling Capacity)	—	47ºF db/43ºF wb Outdoor Air	3.2 COP	3.2 COP	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
			17ºF db/15ºF wb Outdoor Air	2.05 COP	2.05 COP	
Water to Air: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68 °F entering water	4.3 COP	4.3 COP	ISO 13256-1
Water to Air Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50 °F entering water	3.7 COP	3.7 COP	
Brine to Air: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32 °F entering fluid	3.2 COP	3.2 COP	
Water to Water: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68 °F entering water	3.7 COP	3.7 COP	ISO 13256-2
Water to Water: Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50 °F entering water	3.1 COP	3.1 COP	
Brine to Water: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32 °F entering fluid	2.5 COP	2.5 COP	

For SI: 1 British thermal unit per hour = 0.2931 W. $^oC = [(^oF) – 32]/1.8$

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.

b. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE C403.2.3(3)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS,
PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS,
SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
			~~Before 10/08/2012~~	~~As of 10/08/2012~~	
PTAC (cooling mode) new construction	All Capacities	95°F db outdoor air	~~12.5 - (0.213 × Cap/1000) EER~~	~~13.8 - (0.300 × Cap/1000) EER~~ 14.0 – (0.300 × Cap/1000)[c] EER	AHRI 310/380
PTAC (cooling mode) replacements[b]	All Capacities	95°F db outdoor air	~~10.9 - (0.213 × Cap/1000) EER~~	10.9 - (0.213 × Cap/1000) EER	
PTHP (cooling mode) new construction	All Capacities	95°F db outdoor air	~~12.3 - (0.213 × Cap/1000) EER~~	14.0 - (0.300 × Cap/1000) EER	
PTHP (cooling mode) replacements[b]	All Capacities	95°F db outdoor air	~~10.8 - (0.213 × Cap/1000) EER~~	10.8 - (0.213 × Cap/1000) EER	
PTHP (heating mode) new construction	All Capacities	—	~~3.2 - (0.026 × Cap/1000) COP~~	3.2 - (0.026 × Cap/1000) COP	
PTHP (heating mode) replacements[b]	All Capacities	—	~~2.9 - (0.026 × Cap/1000) COP~~	2.9 - (0.026 × Cap/1000) COP	
SPVAC (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	~~9.0 EER~~	9.0 EER	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.6 EER~~	8.6 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	~~9.0 EER~~	9.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.6 EER~~	8.6 EER	
SPVHP (heating mode)	<65,000 Btu/h	47°F db/ 43°F wb outdoor air	~~3.0 COP~~	3.0 COP	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db/ 43°F wb outdoor air	~~3.0 COP~~	3.0 COP	

	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/ 75°F wb outdoor air	~~2.9 COP~~	2.9 COP	
Room air conditioners, with louvered slides	< 6,000 Btu/h	—	~~9.7 SEER~~	9.7 SEER	ANSI/AHAM RAC-1
	≥ 6,000 Btu/h and < 8,000 Btu/h	—	~~9.7 EER~~	9.7 EER	
	≥ 8,000 Btu/h and < 14,000 Btu/h	—	~~9.8 EER~~	9.8 EER	
	≥ 14,000 Btu/h and < 20,000 Btu/h	—	~~9.7 SEER~~	9.7 SEER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air conditioners, with louvered slides	< 8,000 Btu/h	—	~~9.0 EER~~	9.0 EER	
	≥ 8,000 Btu/h and < 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps with louvered sides	< 20,000 Btu/h	—	~~9.0 EER~~	9.0 EER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps without louvered sides	< 14,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
	≥ 14,000 Btu/h	—	~~8.0 EER~~	8.0 EER	
Room air conditioner casement only	All capacities	—	~~8.7 EER~~	8.7 EER	
Room air conditioner casement-slider	All capacities	—	~~9.5 EER~~	9.5 EER	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8.

“Cap” = The rated cooling capacity of the project in Btu/h. If the unit’s capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit’s capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. Replacement unit shall be factory labeled as follows: “MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS.” Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) in height and less than 42 inches (1067 mm) in width.

TABLE C403.2.3(8)
MINIMUM EFFICIENCY REQUIREMENTS: HEAT REJECTION EQUIPMENT

EQUIPMENT TYPE[a]	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION[i]	PERFORMANCE REQUIRED[b, c, d, g, h]	TEST PROCEDURE[e, f]
Propeller or axial fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	~~≥38.2~~ ≥ 40.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or axial fan closed circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal closed circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Propeller or axial fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F *entering wb*	≥ 134,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F *entering wb*	≥ 110,000 Btu/h·hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F *entering wb*	≥ 157,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F *entering wb*	≥ 135,000 Btu/h·hp	CTI ATC-106
Air-cooled condensers	All	125°F Condensing Temperature ~~R-22 Test Fluid~~ 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥ 176,000 Btu/h·hp	ARI 460

For SI: °C = [(°F)-32]/1.8, L/s · kW = (gpm/hp)/(11.83), COP = (Btu/h · hp)/(2550.7)
db = dry bulb temperature, °F, wb = wet bulb temperature, °F.

a. The efficiencies and test procedures for both open and closed circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of wet and dry heat exchange sections.
b. For purposes of this table, open circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition listed in Table 403.2.3(8) divided by the fan nameplate rated motor power.
c. For purposes of this table, closed circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition listed in Table 403.2.3(8) divided by the sum of the fan nameplate rated motor power and the spray pump nameplate rated motor power.
d. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.
e. Chapter 6 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. The certification requirements do not apply to field erected cooling towers.
f. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program, or, if a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report.
g. All cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project specific accessories and / or options included in the capacity of the cooling tower
h. For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power
I. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A shall meet the minimum efficiency requirements listed above with R-507A as the test fluid.

Add new standards as follows:

CTI

ATC 105S-11 Acceptance Test Code for Closed Circuit Cooling Towers
ATC 106-11 Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers

Reason: For consistency with Standard 90.1. This proposal contains all of the increased equipment efficiency requirements found in standard 90.1. As that standard is an alternative path to compliance with the IECC and there is a desire to maintain equivalency of the IECC with 90.1.

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

Analysis: A review of the standard proposed for inclusion in the code, CTI -ATC 105S-2011 Acceptance Test Code for Closed Circuit Cooling Towers, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

A review of the standard proposed for inclusion in the code, CTI-ATC 106-2011 Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE200-13

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

C403.2.3(1)T-EC-FERGUSON.doc

CE201 – 13
C202 (NEW), Table 403.2.3(9) (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new Table as follows:

TABLE C403.2.3 (9)
MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS

Equipment Type	Net Sensible Cooling Capacity[a]	MinimumSCOP-127[b] Efficiency Downflow units / Upflow units	Test Procedure
Air conditioners, air cooled	65,000 Btu/h	2.20 / 2.09	ANSI/ASHRAE 127
	≥65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥240,000 Btu/h	1.90 / 1.79	
Air conditioners, water cooled	65,000 Btu/h	2.60 / 2.49	
	≥65,000 Btu/h and < 240,000 Btu/h	2.50 / 2.39	
	≥240,000 Btu/h	2.40 /2.29	
Air conditioners, water cooled with fluid economizer	65,000 Btu/h	2.55 /2.44	
	≥65,000 Btu/h and < 240,000 Btu/h	2.45 / 2.34	
	≥240,000 Btu/h	2.35 / 2.24	
Air conditioners, glycol cooled (rated at 40% propylene glycol)	65,000 Btu/h	2.50 / 2.39	
	≥65,000 Btu/h and < 240,000 Btu/h	2.15 / 2.04	
	≥240,000 Btu/h	2.10 / 1.99	
Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer	65,000 Btu/h	2.45 / 2.34	
	≥65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥240,000 Btu/h	2.05 / 1.94	

a. Net sensible cooling capacity: The total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power)

b. Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding re-heaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

COMPUTER ROOM. A room whose primary function is to house equipment for the processing and storage of electronic data and that has a design electronic data equipment power density exceeding 20 watts/ft^2 of *conditioned floor area*.

Add new standard to Chapter 5 as follows:

ASHRAE

127-07 Method of Testing for Raining Computer and Data Processing Room Unitary Air Conditioners

Reason: Computer rooms, due to the unique nature of the space, have a significant level of internal heat generation that must be addressed to ensure the equipment therein functions properly. This generally "trumps" any consideration of the sensible or latent loads associated with the people in the space. The cooling equipment that addresses the loads associated with these spaces operates differently and responds to different loads and schedules. This necessitates the efficiency of such equipment be addressed differently than more traditional cooling equipment. ANSI/ASHRAE Standard 127 has been developed for use in measuring and expressing the performance of this equipment for this particular and unique application. This equipment is currently addressed by ASHRAE/IES 90.1-2010, which is adopted as an alternative means of compliance with the IECC. This proposed change addresses the need to cover this unique energy efficiency opportunity in a manner consistent with 90.1-2010. Without this change the IECC Commercial Provisions could not be deemed equivalent to 90.1-2010 or subsequent editions of 90.1 that retain these provisions. More importantly if this change is not approved then the equipment efficiency provisions currently in the IECC would continue to be applied to equipment serving such spaces inappropriately

Cost Impact: The code change proposal will increase the cost of construction as there were previously no requirements for this equipment.

Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 127-2007 Method of Testing for Raining Computer and Data Processing Room Unitary Air Conditioners, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE201-13

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

C403.2.3(9)T-EC-FERGUSON.doc

CE202 – 13
C403.2.3.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.3.1 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s · kW) condenser water flow shall have maximum full-load kW/ton and *NPLV* ratings adjusted using Equations 4-3 and 4-4.

Adjusted minimum full-load COP ratings = (Full-load COP from Table 6.8.1C of AHRI 550/590) × K_{adj} **(Equation 4-3)**

Adjusted minimum NPLV rating = (IPLV from Table 6.8.1C of AHRI 550/590) × K_{adj} **(Equation 4-4)**

where:

K_{adj}	=	A × B
A	=	$0.0000015318 \times (\text{LIFT})^4 - 0.000202076 \times (\text{LIFT})^3 + 0.0101800 \times (\text{LIFT})^2 - 0.264958 \times \text{LIFT} + 3.930196$
B	=	$0.0027 \times L_{vg}^{\text{Evap}}$ (°C) + 0.982
LIFT	=	$L_{vg}^{\text{Cond}} - L_{vg}^{\text{Evap}}$
L_{vg}^{Cond}	=	Full-load condenser leaving water temperature (°C)
L_{vg}^{Evap}	=	Full-load leaving evaporator temperature (°C)

SI units shall be used in the K_{adj} equation.

The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. The leaving evaporator fluid temperature is not less than 36°F (2.2°C).
2. The leaving condenser fluid temperature is not greater than 115°F (46.1°C).
3. LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C).

Exception: Centrifugal chillers designed to operate outside of ~~these~~ the temperature and flow ranges specified in this section need not meet the minimum efficiency requirements in Table C403.2.3(7) ~~need not comply with this code~~.

Reason: This proposal clarifies the code with respect to the type of systems that need not comply with the requirements. The ranges in question (temperature and flow) should be stated to eliminate any confusion as to what "these" refers. The result of the exception is more explicitly stated to refer to the minimum efficiency requirements in Table C403.2.3(7), as there are other requirements of "this code" related to the chiller that still apply, such as part load controls.

Cost Impact: The code change proposal will not increase the cost of construction.

CE202-13

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

C403.2.3.1-EC-WILLIAMS.doc

CE203 – 13
C403.2.3.1, C403.2.3.2, Table C403.2.3(7)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.3.1 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperatureand 2.4 gpm/ton evaporator fluid flow and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s · kW) condenser water flow shall have maximum full-load kW/ton (FL) and ~~*NPLV*~~ part load rating~~s~~ requirements adjusted using Equations 4-3 and 4-4.

~~Adjusted minimum full-load COP ratings = (Full-load COP from Table 6.8.1C of AHRI Standard 550/590) × K_{adj}~~

$FL_{adj} = FL / K_{adj}$

~~Adjusted minimum NPLV rating = (IPLV from Table 6.8.1C of AHRI Standard 550/590) × K_{adj}~~

$PLV_{adj} = IPLV / K_{adj}$ **Equation 4-4)**

where:

K_{adj} = A × B

~~A = 0.0000015318 × (LIFT)^4 – 0.000202076 × (LIFT)^3 + 0.0101800 × (LIFT)^2 – 0.264958 × LIFT + 3.930196~~

~~B = 0.0027 × L_{vg}^{Evap} (°C) + 0.982~~

~~LIFT = L_{vg}^{Cond} – L_{vg}^{Evap}~~

~~L_{vg}^{Cond} = Full-load condenser leaving water temp-erature (°C)~~

~~L_{vg}^{Evap} = Full-load leaving evaporator temperature (°C)~~

~~SI units shall be used in the K_{adj} equation.~~

~~The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:~~

~~1. The leaving evaporator fluid temperature is not less than 36°F (2.2°C).~~

~~2. The leaving condenser fluid temperature is not greater than 115°F (46.1°C).~~

~~3. LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C).~~

~~**Exception:** Centrifugal chillers designed to operate outside of these ranges need not comply with this code.~~

FL = full-load kW/Ton value from Table C403.2.3(7)

FL_{adj} = maximum full-load kW/Ton rating, adjusted for non-standard conditions

IPLV = IPLV value from Table C403.2.3(7)

PLV_{adj} = maximum *NPLV* rating, adjusted for non-standard conditions

A= 0.00000014592 x (LIFT)^4 – 0.0000346496 x (LIFT)^3 + 0.00314196 x (LIFT)^2 – 0.147199 x (LIFT) + 3.9302

B= 0.0015 x LvgEvap + 0.934

LIFT= LvgCond – LvgEvap

LvgCond = Full-load condenser leaving fluid temperature (°F)

LvgEvap = Full-load evaporator leaving temperature (°F)

The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

- Minimum Evaporator Leaving Temperature:36°F
- Maximum Condenser Leaving Temperature:115°F
- 20°F ≤ LIFT ≤ 80°F

C403.2.3.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115°F~~,~~ shall meet the requirements of Table C403.2.3(7) when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

~~TABLE C403.2.3(7)~~
~~MINIMUM EFFICIENCY REQUIREMENTS:~~
~~WATER CHILLING PACKAGES~~[~~a~~]

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~UNITS~~	~~BEFORE 1/1/2010~~		~~AS OF 1/1/2010~~[~~b~~]				~~TEST PROCEDURE~~[~~c~~]
					~~PATH A~~		~~PATH B~~		
			~~FULL LOAD~~	~~IPLV~~	~~FULL LOAD~~	~~IPLV~~	~~FULL LOAD~~	~~IPLV~~	
~~Air-cooled chillers~~	~~< 150 tons~~	~~EER~~	~~≥ 9.562~~	~~≥ 10.416~~	~~≥ 9.562~~	~~≥ 12.500~~	~~NA~~	~~NA~~	~~AHRI 550/590~~
	~~≥ 150 tons~~	~~EER~~			~~≥ 9.562~~	~~≥ 12.750~~	~~NA~~	~~NA~~	
~~Air cooled without condenser, electrical operated~~	~~All capacities~~	~~EER~~	~~≥ 10.586~~	~~≥ 11.782~~	~~Air-cooled chillers without condensers shall be rated with matching condensers and comply with the air-cooled chiller efficiency requirements~~				
~~Water cooled, electrically operated, reciprocating~~	~~All capacities~~	~~kW/ton~~	~~≤ 0.837~~	~~≤ 0.696~~	~~Reciprocating units shall comply with water cooled positive displacement efficiency requirements~~				
~~Water cooled, electrically operated, positive displacement~~	~~< 75 tons~~	~~kW/ton~~	~~≤ 0.790~~	~~≤ 0.676~~	~~≤ 0.780~~	~~≤ 0.630~~	~~≤ 0.800~~	~~≤ 0.600~~	
	~~≥ 75 tons and < 150 tons~~	~~kW/ton~~			~~≤ 0.775~~	~~≤ 0.615~~	~~≤ 0.790~~	~~≤ 0.586~~	
	~~≥ 150 tons and < 300 tons~~	~~kW/ton~~	~~≤ 0.717~~	~~≤ 0.627~~	~~≤ 0.680~~	~~≤ 0.580~~	~~≤ 0.718~~	~~≤ 0.540~~	
	~~≥ 300 tons~~	~~kW/ton~~	~~≤ 0.639~~	~~≤ 0.571~~	~~≤ 0.620~~	~~≤ 0.540~~	~~≤ 0.639~~	~~≤ 0.490~~	
~~Water cooled, electrically operated, centrifugal~~	~~< 150 tons~~	~~kW/ton~~	~~≤ 0.703~~	~~≤ 0.669~~	~~≤ 0.634~~	~~≤ 0.596~~	~~≤ 0.639~~	~~≤ 0.450~~	
	~~≥ 150 tons and < 300 tons~~	~~kW/ton~~	~~≤ 0.634~~	~~≤ 0.596~~					
	~~≥ 300 tons and < 600 tons~~	~~kW/ton~~	~~≤ 0.576~~	~~≤ 0.549~~	~~≤ 0.576~~	~~≤ 0.549~~	~~≤ 0.600~~	~~≤ 0.400~~	
	~~≥ 600 tons~~	~~kW/ton~~	~~≤ 0.576~~	~~≤ 0.549~~	~~≤ 0.570~~	~~≤ 0.539~~	~~≤ 0.590~~	~~≤ 0.400~~	
~~Air cooled, absorption single effect~~	~~All capacities~~	~~COP~~	~~≥ 0.600~~	~~NR~~	~~≥ 0.600~~	~~NR~~	~~NA~~	~~NA~~	~~AHRI 560~~

~~Water cooled, absorption single effect~~	~~All capacities~~	~~COP~~	~~≥ 0.700~~	~~NR~~	~~≥ 0.700~~	~~NR~~	~~NA~~	~~NA~~	
~~Absorption double effect, indirect fired~~	~~All capacities~~	~~COP~~	~~≥ 1.000~~	~~≥ 1.050~~	~~≥ 1.000~~	~~≥ 1.050~~	~~NA~~	~~NA~~	
~~Absorption double effect, direct fired~~	~~All capacities~~	~~COP~~	~~≥ 1.000~~	~~≥ 1.000~~	~~≥ 1.000~~	~~≥ 1.000~~	~~NA~~	~~NA~~	

~~For SI: 1 ton = 3517 W, 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8.~~

~~NA = Not applicable, not to be used for compliance; NR = No requirement.~~

~~a. The centrifugal chiller equipment requirements, after adjustment in accordance with Section C403.2.3.1 or Section C403.2.3.2, do not apply to chillers used in low-temperature applications where the design leaving fluid temperature is less than 36ºF. The requirements do not apply to positive displacement chillers with leaving fluid temperatures less than or equal to 32ºF. The requirements do not apply to absorption chillers with design leaving fluid temperatures less than 40ºF.~~

~~b. Compliance with this standard can be obtained by meeting the minimum requirements of Path A or B. However, both the full load and IPLV shall be met to fulfill the requirements of Path A or B.~~

~~c. Chapter 6 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~

TABLE C403.2.3(7). Water Chilling Packages – Efficiency Requirements [a, b, e]

Equipment Type	Size Category	Units	Effective 1/1/2010 Path A	Effective 1/1/2010 Path B	Effective 1/1/2015 Path A	Effective 1/1/2015 Path B	Test Procedure [c]
Air-Cooled Chillers	< 150 Tons	EER (Btu/W)	≥9.562 FL ≥12.500 IPLV	NA[d]	≥10.100 FL ≥13.700 IPLV	≥9.700 FL ≥15.800 IPLV	AHRI 550/590
	≥150 Tons		≥9.562 FL ≥12.750 IPLV	NA[d]	≥10.100 FL ≥14.000 IPLV	≥9.700 FL ≥16.100 IPLV	
Air-Cooled without Condenser, Electrically Operated	All Capacities	EER(Btu/W)	Air-cooled chillers without condenser must be rated with matching condensers and comply with air-cooled chiller efficiency requirements				
Water-Cooled, Electrically Operated Positive Displacement	< 75 Tons	kW/ton	≤0.780 FL ≤0.630 IPLV	≤0.800 FL ≤0.600 IPLV	≤0.750 FL ≤0.600 IPLV	≤0.780 FL ≤0.500 IPLV	
	≥ 75 tons and <150 tons		≤0.775 FL ≤0.615 IPLV	≤0.790 FL ≤0.586 IPLV	≤0.720 FL ≤0.560 IPLV	≤0.750 FL ≤0.490 IPLV	
	≥ 150 tons and < 300 tons		≤0.680 FL ≤0.580 IPLV	≤0.718 FL ≤0.540 IPLV	≤0.660 FL ≤0.540 IPLV	≤0.680 FL ≤0.440 IPLV	
	≥ 300 tons and < 600 tons		≤0.620 FL ≤0.540 IPLV	≤0.639 FL ≤0.490 IPLV	≤0.610 FL ≤0.520 IPLV	≤0.625 FL ≤0.410 IPLV	
	≥ 600 tons		≤0.620 FL ≤0.540 IPLV	≤0.639 FL ≤0.490 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
Water Cooled, Electrically Operated Centrifugal	< 150 Tons	kW/ton	≤0.634 FL ≤0.596 IPLV	≤0.639 FL ≤0.450 IPLV	≤0.610 FL ≤0.550 IPLV	≤0.695 FL ≤0.440 IPLV	
	≥ 150 tons and <300 tons		≤0.634 FL ≤0.596 IPLV	≤0.639 FL ≤0.450 IPLV	≤0.610 FL ≤0.550 IPLV	≤0.635 FL ≤0.400 IPLV	
	≥ 300 tons and <400 tons		≤0.576 FL ≤0.549 IPLV	≤0.600 FL ≤0.400 IPLV	≤0.560 FL ≤0.520 IPLV	≤0.595 FL ≤0.390 IPLV	
	≥ 400 tons and <600 tons		≤0.576 FL ≤0.549 IPLV	≤0.600 FL ≤0.400 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
	≥ 600 tons		≤0.570 FL ≤0.539 IPLV	≤0.590 FL ≤0.400 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
Air-Cooled Absorption,Single Effect	All Capacities	COP	≥0.600 FL	NA[d]	≥0.600 FL	NA[d]	AHRI 560
Water-Cooled	All	COP	≥0.700 FL	NA[d]	≥0.700 FL	NA[d]	

Absorption, Single Effect	Capacities					
Absorption Double-Effect, Indirect-Fired	All Capacities	COP	≥1.000 FL ≥1.050 IPLV	NA[d]	≥1.000 FL ≥1.050 IPLV	NA[d]
Absorption Double-Effect, Direct-Fired	All Capacities	COP	≥1.000 FL ≥1.000 IPLV	NA[d]	≥1.000 FL ≥1.000 IPLV	NA[d]

[a]The requirements for centrifugal chiller shall be adjusted for non-standard rating conditions per C403.2.3.1and are only applicable for the range of conditions listed in C403.2.3.1. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.
[b] Both the full load and IPLV requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.
[c] NA means the requirements are not applicable for Path B and only Path A can be used for compliance~~.~~
[e] FL is the full load performance requirements and IPLV is for the part load performance requirements

Reason: For consistency with Standard 90.1. This propsoal makes changes to the requirements for air and water cooled chillers as defined in section C403.2.3.1 and the efficiency requirements listed in table C403.2.3(7). This change is a continuation of the efficiency improvements that were implemented in 2010 by further improving the efficiency requirements. In 90.1-2010 a Path B was added for part load intensive water cooled chillers. This change also expands the Path B by adding requirements to include air cooled chillers. Also as part of this change, efforts were made to bring the efficiency requirements for water cooled positive displacement and centrifugal chillers together while considering the available technology, and that chillers can be applied at other application conditions where one technology may better suited than the other. The new efficiency requirements will go into effect on 1/1/2015.

The proposal was develop thru a working team of the AHRI chiller section and a unanimous vote was obtained on the proposal.

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

CE203-13

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

C403.2.3-EC-FERGUSON.doc

CE204 – 13
C403.2.4.1.2, C403.2.4.1.3 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.4.1.2 ~~C403.2.4.2~~ ~~Set point overlap restriction~~ Deadband. Where used to control both heating and cooling, *zone* thermostatic controls shall be capable of providing ~~provide~~ a temperature range or deadband of at least 5°F (2.8°C) within which the supply of heating and cooling energy to the *zone* is ~~capable of being~~ shut off or reduced to a minimum.

Exceptions:

1. Thermostats requiring manual changeover between heating and cooling modes.
2. Occupancies or applications requiring precision in indoor temperature control as *approved* by the *code official.*

C403.2.4.1.3 Setpoint overlap restriction. Where a *zone* has a separate heating and a separate cooling thermostatic control located within the *zone*, a limit switch, mechanical stop, or direct digital control system with software programming shall be provided with the capability to prevent the heating setpoint from exceeding the cooling setpoint and to maintain a deadband in accordance with Section C403.2.4.1.2.

Reason: The text in current Section C403.2.4.2 entitled set point overlap restriction is really focused on deadband and is virtually identical to Section 6.3.4.1.2 of ASHRAE/IES Standard 90.1-2010. For consistency this provision is being renamed deadband and included in a new subsection to C403.2.4.1 on thermostatic controls. In addition ASHRAE/IES Standard 90.1-2010 has a provision to address a different situation wherein a zone has a separate heating and a separate cooling system and a separate thermostat for each one. This situation is not addressed in the IECC and needs to be to prevent a situation where both systems could be operational at the same time. These changes will help make the IECC consistent with ASHRAE/IES 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions.

Cost Impact: The code change proposal will not increase the cost of construction.

CE204-13

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

C403.2.4.1.2-EC-FERGUSON.doc

CE205 – 13
C403.2.4.5 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.4.5 Zone isolation. HVAC systems serving *zones* that are over 25,000 square feet in floor area or that span more than one floor and designed to operate or be occupied non-simultaneously shall be divided into isolation areas. Each isolation area shall be equipped with isolation devices and controls configured to automatically shut off the supply of conditioned air and outdoor air to and exhaust air from the isolation area. Each isolation area shall be controlled independently by a device meeting the requirements of Section C403.2.4.3.2. Central systems and plants shall be provided with controls and devices that will allow system and equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

Exceptions:

1. Exhaust air and outdoor air connections to isolation areas when the fan system to which they connect does not exceed 5000 cfm.
2. Exhaust airflow from a single isolation area of less than 10 percent of the design airflow of the exhaust system to which it connects.
3. Isolation areas intended to operate continuously or intended to be inoperative only when all other isolation areas in a *zone* are inoperative.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the commercial provisions of the IECC, has a provision to provide the ability to create isolation areas within zones under certain circumstances in order to allow for additional reductions in energy use and operating costs. This situation is not addressed in the IECC and should be to ensure technical compatibility between both documents.

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

CE205-13

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

C403.2.4.5 (NEW)-EC-FERGUSON.doc

CE206 – 13
C403.2.4.5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.4.5 Snow melt system controls. Snow – and ice-melting systems~~, supplied through energy service to the building,~~ shall include automatic controls capable of shutting off the system when the pavement temperature is above 50^0F and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40^0F ~~so that the potential for snow or ice accumulation is negligible~~.

Reason: Because the energy for snow and ice-melting systems could come from an energy service other than the energy service for the building, the revision is needed to ensure all energy use for snow melting is covered. This proposal ensures that all snow melting systems are covered by the code. The language at the end of the last sentence being removed is not needed as it is not necessary to explain the intent of the provisions in the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE206-13

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

C403.2.4.5-EC-WILLIAMS.doc

CE207 – 13
C403.2.4.5

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.2.4.5 Snow melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (4°C) ~~so that the potential for snow or ice accumulation is negligible~~.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The text proposed for deletion expresses the intent of the provision, but is in itself unenforceable. The balance of the section adequately describes prescriptive requirements for a snowmelt system. As the prescriptive requirements are clear, there is no need for an 'intent' or 'performance' statement. What might be considered a negligible snow accumulation is Aspen might be considered a blizzard in Key West**.**

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE207-13

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

C403.2.4.5-EC-THOMPSON-SEHPCAC

CE208 – 13
C403.2.4.5, C403.2.4.6 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.4.5 Snow and ice melt system controls. Snow- and ice-melting systems~~, supplied through energy service to the building,~~ shall include automatic controls capable of shutting off the system when the pavement temperature is above 50^0F and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40^0F ~~so that the potential for snow or ice accumulation is negligible~~.

C403.2.4.6 Freeze protection system controls. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls configured to shut off the systems when outdoor air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing.

Reason: For consistency with ASHRAE/IES 90.1-2010. Section 6.4.3.8 of that document contains provisions for freeze protection systems. As that standard is an alternative path to compliance with the IECC and there is a desire to maintain equivalency of the IECC with 90.1 the issue of energy use for freeze protection systems must also be addressed in the IECC. The provisions associated with snow and ice melting systems are in the IECC but are not the same as those in 90.1. Since the energy for snow and ice melting systems could come from service other than to the building the revision is needed to ensure all energy use for snow melting is covered. The language at the end of the last sentence, while in 90.1, is suggested for deletion because it not necessary to explain the intent of the provisions in the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE208-13

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

C403.2.4.5-EC-FERGUSON.doc

CE209 – 13
C403.2.4.6 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com), Jim Edelson, New Buildings Institute

Add new text as follows:

C403.2.4.6 Economizer fault detection and diagnostics (FDD). Air-cooled unitary direct-expansion units listed in Tables C403.2.3(1) through (3) and variable refrigerant flow (VRF) units that are equipped with an economizer in accordance with Section C403.3 or Section C403.4 shall include a fault detection and diagnostics (FDD) system complying with all of the following:

1. The following temperature sensors shall be permanently installed to monitor system operation:
   1.1. Outside air,
   1.2. Supply air,
   1.3. Return air;
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F;
3. Refrigerant pressure sensor, where used, shall have an accuracy of ±3 percent of full scale;
4. The unit controller shall be capable of providing system status by indicating the following:
   4.1. Free cooling available.
   4.2. Economizer enabled.
   4.3. Compressor enabled.
   4.4. Heating enabled.
   4.5. Mixed air low limit cycle active.
   4.6. The current value of each sensor.
5. The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans, and heating system can be independently tested and verified;
6. The unit shall be capable of reporting faults to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats; and
7. The FDD system shall be capable of detecting the following faults:
   7.1. Air temperature sensor failure/fault.
   7.2 Not economizing when the unit should be economizing.
   7.3. Economizing when the unit should not be economizing.
   7.4. Damper not modulating.
   7.5. Excess outdoor air.

Reason: Commercial HVAC systems have been shown to have problems with economizer function, control, and performance in field studies and utility-sponsored maintenance programs. This results in reduced energy efficiency and potential energy savings from the economizer with fan-only operation. The proposed FDD specifications have been standardized in California Title 24-2013.

Major HVAC original equipment manufacturer representatives played a major role in the Title 24 process that developed this measure. They supported the decision to propose the RTU FDD as a Mandatory Measure, rather than a Prescription Option in Title 24. The manufacturer's participants recognized the importance of this technical issue and stated that the industry would be ready by January 2014, the 2013 Title 24 implementation date, to meet the mandatory FDD requirements. A key factor for industry support was that the proposed FDD functions could be implemented on approximately 70% of RTUs sold that are electromechanically controlled, along with higher tier equipment that is microprocessor controlled.

The link to the cost-effectiveness analysis of the Title 24 FDD Mandatory Measure is noted here. The specific FDD reference material is found in three separate places in the document: Pgs. 13-18, 31-45, Appendix B pg. 118-131. http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-04-27_workshop/review/2013_CASE_NR7_HVAC_Controls_and_Economizing_2011_04_20.pdf

Cost and benefit documentation is found in the Li and Braun (2007. Economic Evaluation of Benefits Associated with Automated Fault Detection and Diagnosis in Rooftop Air Conditioners. *ASHRAE Transactions* 113(2).) report, which states "Automated FDD reduces service costs due to reduced preventive maintenance inspections, fault prevention, lower-cost FDD, better scheduling of multiple service activities, and shifting service to low season."

Cost Impact: The code change proposal will increase the cost of construction but the increased level of efficiency over the life of the equipment will exceed the initial first cost.

CE209-13

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

C403.2.4.6 (NEW)-EC-EDELSON-MAKELA.doc

CE210 – 13
C403.2.5.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) shall be provided for spaces larger than ~~500~~ 200 square feet (~~50~~ 20 m^2) and with a design ~~an average~~ occupant load of not less than 25 people per 1000 square feet (93 m^2) of floor area (as established in Table 403.3 of the *International Mechanical Code*) and served by systems with one or more of the following:

1. An air-side economizer;
2. Automatic modulating control of the outdoor air damper; or
3. A design outdoor airflow greater than 3,000 cfm (1400 L/s).

Exception: Demand control ventilation is not required for systems and spaces as follows:

1. Systems with energy recovery complying with Section C403.2.6.
2~~. Multiple-*zone* systems without direct digital control of individual *zones* communicating with a central control panel.~~
~~3.~~ 2. System with a design outdoor airflow less than ~~1,200~~ 100 cfm (~~600~~ 50 L/s).
~~4.~~ 3. Spaces where the ~~supply~~ space outside airflow rate minus any makeup or outgoing transfer air exhausted from other spaces ~~requirement~~ is less than ~~1,200~~ 50 cfm (~~600~~ 25 L/s).
~~5.~~ 4. Ventilation provided for process loads only.

Reason: This proposal reduces thresholds associated with space size and design occupant density at which demand controlled ventilation (DCV) is required.

DCV reduces the amount of energy needed to ventilate and condition spaces with high-density occupancy because it allows the mechanical system to modulate ventilation based on occupant load, rather than always providing ventilation based on full design occupancy. In the time since the provisions for DCV were first included in the IECC, the cost for DCV has been reduced. DCV is now cost effective in smaller spaces than are covered in the current code.

DCV in smaller spaces can also be achieved with lower cost occupancy sensors, allowing fans on single zone systems to cycle or closing zone boxes on VAV systems when spaces are unoccupied.

The exception for multiple zone systems without DDC is removed for three reasons: (1) almost all multiple zone systems installed today have DDC control, (2) it is possible to provide DCV controls at the zone level without DDC, and (3) there are significant savings from ventilation control for zones in multiple zone systems due to high minimum airflow requirements under the International Mechanical Code in high density spaces.

The cost increase associated with this code change is limited to spaces from 201 to 500 ft^2 in floor area that are not subject to the exceptions because those spaces currently do not require DCV and, pursuant to this code change, would now need DCV.
A detailed cost analysis conducted in support of similar provisions in California Title 24 (the California Energy Code) indicated that DCV was cost effective down to spaces 150 ft^2 in floor area. The cost effectiveness was shown for spaces supplied by VAV systems that were vacant on average 2 hours per weekday and for constant volume systems that were vacant on average 4 hours per weekday. This analysis was for relatively mild climates. In colder or warmer climates, more energy is used for heating or cooling ventilation air, so if the technology was cost effective in California, it will have greater savings and better cost effectiveness in colder or warmer climates. The incorporation of occupancy sensors into DCV controls and requirements for lighting occupancy sensors in most high-density spaces has also resulted in reduced incremental cost. As a result, occupancy sensor based DCV is cost effective in smaller spaces.

References:

2013 California Building Energy Efficiency Standards. 2011. Light Commercial Unitary HVAC
http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/HVAC/2013_CASE_NR_Light_Commercial_Unitary_UPDATED_Nov_2011.pdf

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

CE210-13

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

CE211 – 13
C403.2.5.2 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.5.2 Enclosed parking garage ventilation controls. Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ contamination sensing devices and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with IMC provisions. Failure of contamination sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with total exhaust capacity less than 22,500 cfm (10,600 L/s) with ventilation systems that do not utilize heating or mechanical cooling.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has requirements for ventilation optimization control on parking ventilation systems that are not included in the IECC. These provisions provide significant energy savings. The change ensures continued consistency between the IECC and standard 90.1-2010 and provides significant energy savings in IECC.

Cost Impact: This code change proposal will increase the cost of construction when controls are now required.

CE211-13

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

C403.2.5.2 (NEW)-EC-FERGUSON.doc

CE212 – 13
C403.2.6

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Revise as follows:

C403.2.6 Energy recovery ventilation systems. Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.6, the system shall include an energy recovery system. The energy recovery system shall have the capability to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls which permit operation of the economizer as required by Section C403.4

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
2. Laboratory fume hood systems that include at least one of the following features:
   2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values <u>except when higher volumes are required to maintain safe operating conditions</u>.
   2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and are not cooled.
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
5. Heating energy recovery in Climate Zones 1 and 2.
6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design *outdoor air* flow rate.
9. Systems expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table C403.2.6
10. <u>Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.</u>
11. <u>Commercial kitchen hoods used for collecting and removing grease vapors and smoke</u>.

Reason: Public health, safety and welfare takes precedence over reducing energy consumption, and the revision to Item 2.1 recognizes that with laboratory fume hoods. Additional exceptions 10 and 11 identify systems where energy recovery should not be used because what is being exhausted could be detrimental or destructive to any energy recovery equipment. All of these provisions are contained in the current Minnesota Commercial Energy Code.

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

CE212-13

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

C403.2.6-EC-MANZ.doc

CE213 – 13
Table C403.2.6, Table C403.3.1(1), Table C403.3.1.1.3(1), Table C403.3.1.1.3(2)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C403.2.6
ENERGY RECOVERY REQUIREMENT

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE					
	≥30% and < 40%	≥40% and < 50%	≥50% and < 60%	≥60% and < 70%	≥70% and < 80%	≥80%
	DESIGN SUPPLY FAN AIRFLOW RATE (cfm)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥ 5000	≥ 5000
~~1B,~~ 2B, 5C	NR	NR	≥ 26000	≥ 12000	≥ 5000	≥ 4000
6B	≥ 11000	≥ 5500	≥ 4500	≥ 3500	≥ 2500	≥ 1500
1A, 2A, 3A, 4A, 5A, 6A	≥ 5500	≥ 4500	≥ 3500	≥ 2000	≥ 1000	> 0
7, 8	≥ 2500	≥ 1000	> 0	> 0	> 0	> 0

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, ~~1B~~	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 Btu/h[a]

(Portions of Table not shown remain unchanged)

TABLE C403.3.1.1.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
~~1B,~~ 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1A, 2A, 3A, 4A	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climate zones	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	--

(Portions of Table not shown remain unchanged)

TABLE C403.3.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	~~1B,~~ 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	$T_{OA} > 75^{o}F$	Outdoor air temperature exceeds $75^{o}F$
	5A, 6A, 7A	$T_{OA} > 70^{o}F$	Outdoor air temperature exceeds $70^{o}F$
	All other zones	$T_{OA} > 65^{o}F$	Outdoor air temperature exceeds $65^{o}F$
Differential dry bulb	~~1B,~~ 2B, 2B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature

(Portions of Table not shown remain unchanged)

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:

There are no listings of a climate zone 1B in Table C301.1 and Climate Zone 1B does not appear in Figure C301.1. Therefore the SEHPCAC believes that the zone should not be included in the regulations.

Please note that the table has been editorially revised to properly align the information in the Climate Zone column with the Equation and Description Columns.

Cost Impact: The code change proposal will not increase the cost of construction The change is editorial in nature and will not affect construction costs.

CE213-13

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

C403.2.6-EC-THOMPSON-SEHPCAC

CE214 – 13
Table C403.2.6

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.6
ENERGY RECOVERY REQUIREMENT

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥10% and <20%	≥20% and <30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	DESIGN SUPPLY FAN AIRFLOW RATE (cfm)							
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	NR	NR	~~≥5000~~ NR	~~≥5000~~ NR
1B, 2B, 5C	NR	NR	NR	NR	≥26000	≥12000	≥5000	≥4000
6B	≥28000	≥26500	≥11000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥26000	≥16000	≥5500	≥4500	≥3500	≥2000	≥1000	> 0
7, 8	≥4500	≥4000	≥2500	≥1000	> 0	> 0	> 0	> 0

NR = not required

Reason: This proposal revises the requirements for the use of exhaust air energy recovery as defined in table C403.2.6

The current table requires energy recovery as a function of the percent outdoor air and design supply fan airflow. The current table defines requirements for energy recover for outdoor air ventilation rates above 30%. Many buildings operate with ventilation rates below 30%. Typical buildings in this category include offices, motels, hotels, grocery, and warehouses which represent a significant part of the market. Therefore by extending the table down we can save additional energy on these buildings where economically justified. SSPC 90.1 ran full 8760 hr simulation runs for building office, school and retail applications down to 10% outdoor air and then selected least restrictive cfm values for the table based on the 2010 scalar ratio metholody using a design life of 15 years. This results in additional requirements for energy recovery on larger systems in zones 1A, 2A, 3A, 4A, 5A, 6A, 7 and 8. These zones represent 30.8% of the market.

In addition to the changes to extend the table down low percent outdoor air ventilation rates, this also proposes to modify the requirements for zone 3B, 3C, 4B, 4C and 5B as they are not economical justified and have scalar values of 20.3 yrs up to infinity. We have received feedback that other studies have also confirmed that these values are not cost effective and it is felt these values need to be corrected.

The change ensures continued consistency between the IECC and Standard 90.1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE214-13

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

C403.2.6-EC-FERGUSON.doc

CE215 – 13
C403.2.7

Proponent: Ron Burton, PTW Advisors, LLC, representing BOMA International (ronburton@ptwadvisors.com)

Revise as follows:

C403.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and a minimum of R-8 insulation where located outside the building. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by minimum of R-8 insulation.

Exceptions:

1. Where located within equipment
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15° F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

<u>**Exception:** Ducts and plenums located completely inside the building thermal envelope</u>

Reason: To provide and exception to not require insulation on ducts and plenums, when the ducts and plenums are completely inside the building thermal envelope. This is the same as the provision already allowed in the residential portion of the code. Heat loss or gain from the ducts and plenums inside the conditioned space is only released to the conditioned area and thus does not have an impact on energy use.

Cost Impact: This code change proposal will not increase the cost of construction. The change will have a cost savings by exempting the required insulation on ducts and plenums.

CE215-13

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

C403.2.7-EC-BURTON.doc

CE216 – 13
C403.2.7

Proponent: Mark Terzigni, Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) (mterzigni@smacna.org)

Revise as follows:

C403.2.7 Duct and plenum insulation. ~~and sealing~~. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and a minimum of R-8 insulation where located outside the building. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. Where located within equipment
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8 °C).

~~All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.~~

Reason: "Air handlers" should not be addressed under ducts and plenums. All sealing concerns should be addressed in the next section proposed C403.2.8 "insulation and sealing" are two distinct topics and should not be lumped together.

Cost Impact: This code change proposal will not increase the cost of construction.

CE216-13

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

C403.2.7-EC-TERZIGNI.doc

CE217 – 13
C403.2.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and ~~a minimum of R-8 insulation~~ where located outside the building with a minimum of R-8 insulation in climate zones 1 through 4 and a minimum of R-12 insulation in climate zones 5 through 8. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation in climate zones 1 through 4 and a minimum of R-12 insulation in climate zones 5 through 8.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Reason: This proposal reduces the energy loss associated with duct systems, such as those in cold climates, by increasing the level of insulation required on ducts and plenums where it is cost effective.

Exterior ducts and plenums (i.e. those not totally inside the building conditioned space) in colder climate zones are subject to a higher heat loss and consequent higher use of energy due to a greater temperature difference across the duct or plenum surface. As the cost of energy increases and the need to reduce building energy use becomes more acute, enhancements to the energy code are necessary. Such ducts and plenums will benefit from improved insulation because the added insulation will reduce heat loss and allow more of the heat provided by the HVAC equipment to be delivered to the space. In some cases the added insulation will also allow reduced heating equipment size.

There is a cost impact associated with this proposed change since more insulation will be required on some ductwork in climate zones 5-8. A cost effectiveness analysis was completed. In this analysis it was found that for the additional duct insulation the simple payback was 11.2 years or less. Based on insulation life of 24 years, a discounted cost effective payback threshold is 14.2 years. The simple paybacks for all of the additional insulation required under this proposal are well below this cost effective threshold.

References:

R. Hart. 2012. Supporting Analyses for proposed changes to the commercial provisions of the 2012 IECC: Increase Duct and Plenum Insulation. http://www.energycodes.gov/development/commercial/2015IECC

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

CE217-13

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

C403.2.7-EC-WILLIAMS.doc

CE218 – 13
C403.2.7

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Revise as follows:

C403.2.7 Duct and plenum insulation and sealing. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind. Insulation exposed to weather shall be suitable for outdoor service and shall be protected by aluminum, sheet metal, painted canvas, plastic cover or other similar materials approved by the code official. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material. All supply, ~~and~~, return, exhaust and relief air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and a minimum of R-8 insulation where located outside the building. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Reason: This proposed amendment incorporates language from the current Minnesota Commercial Energy Code, along with provisions from ASHRAE Standard 90.1-2010 that explain in detail the requirements necessary to protect ducts from physical damage and from other sources of damage, such as moisture and weather-related elements. These changes are necessary so that the insulation protection provides energy efficient and durable systems that are not likely to deteriorate due to the formation of condensation on the interior or exterior of the ducts or plenums.

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

CE218-13

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

C403.2.7-EC-MANZ.doc

CE219 – 13
C403.2.7

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Revise as follows:

C403.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and a minimum of R-8 insulation where located outside the building. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Air handlers 3000 cfm or less shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Reason: This adds the same airtight air handler requirement as is in residential. The standard is already in use in the industry. The requirement is limited to air handlers of 3000 cfm or less because that is the limit of the ASHRAE 193 test. Having a manufacturer's designation of a certain leakage or less makes inspection much simpler.

Cost Impact: The code change proposal will not increase the cost of construction.

CE219-13

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

C403.2.7-EC-CONNER.doc

CE220 – 13
C403.2.7 (NEW), Table C403.2.7 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.7 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.
When total kitchen hood exhaust airflow rate is greater than 5,000 cfm each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

1. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted.
2. Demand ventilation systems on at least 75 percent of the exhaust air that are capable of at least 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.
3. Listed energy recovery devices with a sensible heat recovery effectiveness of at least 40 percent on at least 50 percent of the total exhaust airflow.

When a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

Exception: When at least 75 percent of all the replacement air is transfer air that would otherwise be exhausted

TABLE C403.2.7
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Pass-over	210	210	280	Not allowed

Reason: For consistency with Standard 90.1-2010. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation, ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

The proposal basically outlaws "short-circuit" hoods.

Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air. The proposed change is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table C403.2.7 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003.

ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods it should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold recognizes small restaurants. In addition makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices.

Cost Impact: The code change proposal will not increase the cost of construction.

CE220-13

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

C403.2.7 (NEW)-EC-FERGUSON.doc

CE221 – 13

C403.2.7.1, C403.2.7.1.1, C403.2.7.1.2, C403.2.7.1.3, C403.2.8 (NEW), C403.2.8.1 (NEW), C403.2.8.3 (NEW)

Proponent: Mark Terzigni, Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) (mterzigni@smacna.org)

Delete and substitute as follows:

~~**C403.2.7.1 Duct construction**. Ductwork shall be constructed and erected in accordance with the *International Mechanical Code*.~~

~~**C403.2.7.1.1 Low-pressure duct systems.** All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus embedded- fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.~~

> ~~**Exception:** Continuously welded and locking type longitudinal joints and seams on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.~~

~~**C403.2.7.1.2 Medium-pressure duct systems.** All ducts and plenums designed to operate at a static pressure greater than 2 inches water gauge (w.g.) (500 Pa) but less than 3 inches w.g. (750 Pa) shall be insulated and sealed in accordance with Section C403.2.7. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.~~

~~**C403.2.7.1.3 High-pressure duct systems.** Ducts designed to operate at static pressures in excess of 3 inches water gauge (w.g.) (750 Pa) shall be insulated and sealed in accordance with Section C403.2.7. In addition, ducts and plenums shall be leak-tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual* with the rate of air leakage (*CL*) less than or equal to 6.0 as determined in accordance with Equation 4-5.~~

~~$CL = F/P^{0.65}$~~ ~~**(Equation 4-5)**~~

~~where:~~

~~F = The measured leakage rate in cfm per 100 square feet of duct surface.~~
~~P = The static pressure of the test.~~

~~Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.~~

C403.2.8 Duct construction Ductwork shall be constructed and erected in accordance with the *International Mechanical Code*

C403.2.8.1 Sealing requirements. Ductwork shall meet Seal Class A as defined below

Seal Class A requires that all joints, seams, and penetrations be sealed.

Exceptions:

1. Joints, seams, and penetrations where sealing would void listings, warranties, or inhibit proper use of the device.
2. Spiral seams.
3. Joints, seams, and penetrations sealed by gaskets.
4. Sheet metal screws.
5. Continuously welded seams.
6. Ductwork exposed to view and located in conditioned space.

Sealants shall comply with the *International Mechanical Code.*

C403.2.8.2 Duct air leakage testing. Ductwork shall be leak tested in accordance with *SMACNA HVAC Air Duct Leakage Test Manual* with the following requirements:

20 percent of the ductwork, based on surface area, shall be tested for air leakage. If the tested sections pass, the testing concludes.

If the tested sections fail, the deficiencies shall be corrected, and an additional 20 percent of the ductwork, based on surface area, shall be tested for air leakage. If the tested sections pass the testing concludes.

If the additional tested sections fail, the deficiencies shall be corrected, and the remainder of the ductwork shall be tested for air leakage and any deficiencies shall be corrected.

The acceptable rate of air leakage shall be determined in accordance with Equation 4-5

$$F = C_L \times P^{0.65} \qquad \text{(Equation 4-5)}$$

where:

F = the measured leakage rate in cfm per 100 square feet of duct surface.
C_L = the leakage class which is less than or equal to 4 cfm per 100 square feet of duct surface area @ 1 in. w.g.
P = the static pressure of the test (in. w.g.) which cannot exceed the lowest designed operating pressure of any portion of the tested section

Exceptions: Leakage testing in accordance with this section is not required for the following:

1. Ductwork that is located in conditioned space
2. Ductwork subject to other leakage tests in accordance with the *International Mechanical Code, International Building Code* or *International Fire Code*
3. Exhaust ductwork used for any application other than odor removal

Reason: The above proposal properly addresses duct air leakage testing in a practical and beneficial manner.

1. Allows duct at any pressure to be leak tested
2. Reduces the allowable leakage from class 6 to class 4 – 33% reduction
3. Requires that essentially all duct be sealed to the most stringent seal class "a"
4. Provides direction if there is a test failure and requires remediation
5. Requires additional testing, up to 100% of the duct when warranted, which balances cost and effectiveness
6. Reduces energy usage without excessive requirements
7. This is a significant improvement over the existing requirements

Cost Impact: The code change proposal may increase the cost of construction depending on the specific project. SMACNA believes that this approach is the best balance between cost and reducing energy consumption.

CE221-13

Public Hearing: Committee: AS AM D

Assembly: ASF AMF DF

C403.2.7.1-EC-TERZIGNI.doc

CE222 – 13
C403.2.7.1.1

Proponent: Vickie Lovell InterCode Inc. representing DuctMate Industries (vickie@intercodeinc.com)

Revise as follows:

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus embedded- fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

> **Exception:** ~~Continuously welded and locking type longitudinal joints and seams on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.~~ <u>For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams of other than the snap-lock and button-lock types.</u>

Reason: This proposed text is derived from a revision to the International Mechanical Code that was proposed by the PMG Code Action Committee in M151-12 and was approved by the voting membership in Portland for the 2015 IMC.

Unless sealant or a gasket is used, snap-lock and button-lock type seams will leak significantly. The current exception attempted to prevent unnecessary sealing for joints and seams that leak very little or not at all, but it went too far by including all locking type joints and seams. Some locking joints are leak proof such as mechanically folded seams used for spiral seam duct, but this is not true for all locking joints.

The purpose of this code change is to create consistency between the IMC and the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE222-13

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

C403.2.7.1.1-EC-LOVELL.doc

CE223 – 13
C403.2.7.1.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

> **Exception:** ~~Continuously welded and l~~Locking-type longitudinal joints and seams need not be sealed as specified in this section ~~on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification~~.

Reason: This proposal clarifies that locked joint construction methods for duct systems meet the code for longitudinal seams. The requirement clearly allows welded longitudinal seems to be acceptable, so that is not needed in the exception. As currently stated in the exception, it might be interpreted that the longitudinal seam must be both welded and locking. That is clearly not the intent, as welding and locking together are not typical duct sealing approaches.

Cost Impact: The code change proposal will not increase the cost of construction.

CE223-13

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

C403.2.7.1.1-EC-WILLIAMS.doc

CE224 – 13
C403.2.7.1.1

Proponent: Amanda Hickman, InterCode Inc. representing DuctMate Industries (amanda@intercodeinc.com)

Revise as follows:

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus embedded- fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

> ~~**Exception:** Continuously welded and locking type longitudinal joints and seams on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.~~

Reason: The requirements for low pressure duct sealing were clarified in the International Mechanical Code in M151-12 (proposed by the PMG Code Action Committee). M151-12 was approved by the voting membership in Portland for the 2015 IMC.

Currently, low pressure duct sealing is addressed in the IMC, two places in the IECC, and in the IRC. Identical language in the IECC is not necessary since it defers to the IMC and the IRC (for residential mechanical).

If the code sections in the IMC, IRC, and IECC are not maintained cycle after cycle, inconsistencies can develop between the sections. It is more efficient to simply eliminate the sections altogether in the IECC since they are redundant.

A similar proposal is being submitted to the 2015 IECC residential chapter for consistency.

Cost Impact: The code change proposal will not increase the cost of construction.

CE224-13

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

C403.2.7.1.1-EC-HICKMAN.doc

CE225 – 13
C403.2.7.1.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7.1.3 High-pressure duct systems. Ducts and plenums designed to operate at static pressures ~~in excess of~~ greater than 3 inches water gauge shall be insulated and sealed in accordance with Section C403.2.7. In addition, ducts and plenums shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual ~~with the~~ and shown to have a rate of air leakage (CL) less than or equal to 6.0 as determined in accordance with Equation 4-5.

$CL = F/P^{0.65}$ **(Equation 4-5)**

where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.
P = The static pressure of the test.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.

Reason: This proposal ensures consistency with the provisions in Section C403.2.7.1.2.

Cost Impact: The code change proposal will not increase the cost of construction.

CE225-13

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

C403.2.7.1.3-EC-WILLIAMS.doc

CE226 – 13
403.2.7.1.3

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferugson@ashrae.org)

Revise as follows:

C403.2.7.1.3 High-pressure duct systems. <u>All</u> ducts <u>and plenums</u> designed to operate at static pressures in excess of 3 inches water gauge (750 Pa) shall be insulated and sealed in accordance with Section C403.2.7. In addition, ducts and plenums shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual with the rate of air leakage (CL) less than or equal to ~~6.0~~ <u>4.0</u> as determined in accordance with Equation 4-5.

$$CL = F/P^{0.65} \qquad \textbf{(Equation 4-5)}$$

where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.

P = The static pressure of the test.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct <u>system</u> area have been tested and that all tested sections meet the requirements of this section.

Reason: Consistency with the provisions in Section C403.2.7.1.2. In addition ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to limit the air leakage rate to 4.0. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE226-13

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

C403.2.7.1.3-EC-FERGUSON.doc

CE227 – 13
C403.2.8 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.8 Laboratory exhaust systems. Buildings with laboratory exhaust systems having a total exhaust rate greater than 5,000 cfm shall be provided with at least one of the following:

1. A VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates to the minimum required in the *International Mechanical Code*
2. A VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates by at least 50 percent of design condition.
3. A heat recovery system to precondition makeup air from laboratory exhaust with at least a 50 percent sensible recovery effectiveness.

~~3.~~4. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust air flow rate that is not heated above room setpoint or cooled below room setpoint and does not utilize non-adiabatic humidification.

Reason: For consistency with Standard 90.1-2010. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation, ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IES Standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE227-13

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

C403.2.8 (NEW)-EC-FERGUSON.doc

CE228 – 13
C403.2.8.1

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Revise as follows:

C403.2.8.1 Protection of piping insulation. Piping insulation ~~exposed to weather~~ shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted. <u>In addition, piping insulation shall comply with the following:</u>

1. <u>Insulation exposed to weather shall be suitable for outdoor service and shall be protected by aluminum, sheet metal, painted canvas, plastic cover or other similar materials approved by the code official. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.</u>
2. <u>Insulation covering chilled-water piping or refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation ,or the insulation shall be installed at a thickness that qualifies as a Class I or Class II vapor retarder.</u>

Reason: The proposed code change incorporates language from ASHRAE Standard 90.1-2010 that specifies protection for piping insulation where it is subject to damage, whether inside or outside the building. These changes are necessary to ensure that the pipe insulation and vapor retarder are maintained throughout the life of the system and are not destroyed prematurely by water or moisture intrusion which may deteriorate the insulation and/or vapor retarder. This results in energy efficient and durable piping systems.

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

CE228-13

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

C403.2.8.1-EC-MANZ.doc

CE229 – 13
Table C403.2.8

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.8
MINIMUM PIPE INSULATION THICKNESS (thickness in inches)[a]

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu · in./(h · ft² · °F)~~[b]~~	Mean Rating Temperature, °F	<1	1 to < $1^1/_2$	$1^1/_2$ to < 4	4 to < 8	≤ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	~~75~~ 50	0.5	1.0	1.0	1.0	1.5

(Portions of Table not shown remain unchanged)

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has a different mean rating temperature for evaluating the thermal properties of insulation on piping serving fluids below 40°F. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE229-13

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

C403.2.8T-EC-FERGUSON.doc

CE230 – 13
C403.2.8.2 (NEW), R403.3.2 (NEW) (IRC N1103.2 (NEW))

Proponent: Howard Ahern, Airex Mfg., representing self (howard.ahern@airexmfg.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

<u>**C403.2.8.2 Chilled water and refrigerant suction piping.** Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a Class I or Class II vapor retarding facing located outside the insulation. Piping insulation protection shall be removable and reusable. Piping insulation shall be in accordance with Section C403.2.8.1.</u>

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

<u>**R403.3.2 (N1103.3.2) Refrigerant suction piping.** Insulation covering refrigerant suction piping located outside the conditioned space shall include a Class I or Class II vapor-retardant facing located on the outside of the insulation. Piping insulation protection shall be removable and reusable. Piping insulation shall be in accordance with Section R403.3.</u>

Reason: The use of Vapor Retarders with suction line pipe insulation has been a requirement of the ASHRAE 90.1 Standard going back to 2004. This code change is needed need to specify requirements for Chilled water and refrigerant suction piping. This change will ensures steady, long-term thermal performance, and prevent the transference of moisture**.** Preventing moisture exchange will help prevent Wet insulation and maintain system integrity, sustainability, and energy savings of the insulation. Preventing moisture transference will also help prevent the growth of mold.

All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, maintenance provides an excuse for the suction line insulation to be touched and or removed. Pipe insulation removal from suction lines often results in damage to the insulation itself requiring replacement.

<u>Protection for the suction piping insulation therefore need to be removable and reusable.</u> This will help insure system integrity and sustainability of the pipe insulation, reducing replacement.

Cost Impact: This code change will increase cost; For the vapor retarders only and not will not increase cost in those jurisdictions that use ASHRAE Standard 90.1 as vapor retarders has been part of ASHRAE Standard 90.1 since 2004.

CE230-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C403.2.8.2-EC-AHERN.doc

CE231 – 13
C403.2.10, C403.2.10.1, Table C403.2.10.1(1), Table C403.2.10.1(2)

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Delete without substitution as follows:

~~**C403.2.10 Air system design and control.** Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) shall meet the provisions of Sections C403.2.10.1 through C403.2.10.2.~~

~~**C403.2.10.1 Allowable fan floor horsepower.** Each HVAC system at fan system design conditions shall not exceed the allowable fan system motor nameplate hp (Option 1) or fan system bhp (Option 2) as shown in Table C403.2.10.1(1). This includes supply fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single zone variable-air-volume systems shall comply with the constant volume fan power limitation.~~

~~**Exception:** The following fan systems are exempt from allowable fan floor horsepower requirement.~~

1. ~~Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.~~
2. ~~Individual exhaust fans with motor nameplate horsepower of 1 hp or less.~~

~~**C403.2.10.2 Motor nameplate horsepower.** For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower (bhp). The fan brake horsepower (bhp) shall be indicated on the design documents to allow for compliance verification by the code official.~~

~~**Exceptions:**~~

1. ~~For fans less than 6 bhp (4413 W), where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~
2. ~~For fans 6 bhp (4413 W) and larger, where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~

~~**TABLE C403.2.10.1(1)**~~
~~**FAN POWER LIMITATION**~~

~~**TABLE C403.2.10.1(2)**~~
~~**FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT**~~

Reason: Checking the fan horsepower is impractical. This part of the code is seldom enforced, or even taught in class.

Cost Impact: The code change proposal will not increase the cost of construction.

CE231-13

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

C403.2.10-EC-CONNER.doc

CE232 – 13
C403.2.10, C403.2.10.3 (NEW)

Proponent: Michael Ivanovich, AMCA International (mivanovich@amca.org)

Revise as follows:

C403.2.10 Air system design and control. Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) shall meet the provisions of Sections C403.2.10.1 through ~~C403.2.10.2~~ <u>C403.2.10.3</u>.

<u>**C403.2.10.3 Fan efficiency verification.** The efficiency of fans shall be verified through certification under an *approved* certification program or, where no certification program exists, the fan efficiency ratings shall be supported by data furnished by the manufacturer.</u>

Reason: The energy usage of fans is under increasing scrutiny by designers, building owners, commissioning agents, code enforcement professionals, federal agencies, and other code users. This code change proposal requires fan manufacturers to provide relevant information related to the energy efficient performance of their products. The proposed language has been extracted from the IECC section on HVAC equipment in Section C403.2.3 as an equipment performance requirement. It is applicable to fan products.

Cost Impact: The code change proposal will not increase the cost of construction.

CE232-13

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

C403.2.10-EC-IVANOVICH.doc

CE233 – 13
C202 (NEW), C403.2.10, C403.2.10.3 (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.10 Air system design and control. Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) shall meet the provisions of Sections C403.2.10.1 through ~~C403.2.10.2~~ <u>C403.2.10.3</u>.

<u>**C403.2.10.3 Fan efficiency.** Fans shall have a *fan efficiency grade* (FEG) of at least 67 when determined in accordance with AMCA 205 by an *approved*, independent testing laboratory. In addition the total efficiency of the fan at the design point of operation shall be within 15 percentage points of the maximum total efficiency of the fan.</u>

<u>**Exceptions:**</u>

1. <u>Single fans with a motor nameplate horsepower of 5 hp or less, unless Exception 2 applies.</u>
2. <u>Multiple fans in series or parallel (e.g. fan arrays) that have a combined motor *nameplate horsepower* of 5 hp or less and are operated as the functional equivalent of a single fan.</u>
3. <u>Fans that are part of equipment covered under Section C403.2.3.</u>
4. <u>Fans included in an equipment package certified by an *approved agency* for air or energy performance.</u>
5. <u>Powered wall/roof ventilators,</u>
6. <u>Fans outside the scope of AMCA 205.</u>
7. <u>Fans that are intended to operate during only emergency conditions.</u>

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**FAN EFFICIENCY GRADE (FEG).** A numerical rating identifier that specifies the fan's aerodynamic ability to convert shaft power, or impeller power in the case of a direct driven fan, to air power. FEGs are based on fan peak (optimum) energy efficiency that indicates the quality of the fan energy usage and the potential for minimizing the fan energy usage</u>.

Add new standard to Chapter 5 as follows:

AMCA

<u>205-12 Energy Efficiency Classification for Fans</u>

Reason: ASHRAE/IES Standard 90.1, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to address the minimum efficiency of air system fans. The change ensures continued consistency between the IECC Commercial Provisions and standard 90.1.

The IECC Commercial Provisions do not currently have any provisions for fan efficiency. It is important and appropriate for the IECC Commercial Provisions to address this issue. The Section C 403.2.10 of the IECC Commercial Provisions addresses air system design and control and should be updated to include the criteria from standard 90.1-2010 as enhanced by this addendum in order to retain technical compatibility between the IECC Commercial Provisions and standard 90.1.

Fan power limits have been in the code for some time. These limits place restrictions on the design of systems and the amount of fan energy utilized. However the code has not had a requirement for a minimum fan efficiency. A fan efficiency metric was developed with fans being classified based on fan efficiency grades. This system is designated in AMCA 205-12.

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

Analysis: A review of the standard proposed for inclusion in the code, AMCA 205-2012 Energy Efficiency Classification for Fans, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

Note: The term 'fan efficiency grade' is currently defined in the IgCC. The wording of this proposal is identical to the IgCC definition.

CE233-13

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

C403.2.10-EC-FERGUSON.doc

CE234 – 13
C202 (NEW), C403.2.10, C403.2.10.3 (NEW), Chapter 5

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C403.2.10 Air system design and control. Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) shall meet the provisions of Sections C403.2.10.1 through ~~C403.2.10.2~~ C403.2.10.3.

C403.2.10.3 Fan efficiency. Fans shall have a fan efficiency grade (FEG) of at least 67 when determined in accordance with AMCA 205 by an *approved*, independent testing laboratory and labeled by the manufacturer. The total efficiency of the fan at the design point of operation shall be within 15 percentage points of the maximum total efficiency of the fan.

Exceptions: The following fans are not required to have a fan efficiency grade:

1. Fans of 5 hp or less as follows:
   1.1 Single fan with a motor nameplate horsepower of 5 hp or less, unless Exception 1.2 applies.
   1.2 Multiple fans in series or parallel that have a combined motor nameplate horsepower of 5 hp or less and are operated as the functional equivalent of a single fan.
2. Fans that are part of equipment covered under Section C403.2.3.
3. Fans included in an equipment package certified by an *approved agency* for air or energy performance.
4. Powered wall/roof ventilators.
5. Fans outside the scope of AMCA 205.
6. Fans that are intended to operate only during emergency conditions.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

FAN EFFICIENCY GRADE (FEG). A numerical rating identifier that specifies the fan's aerodynamic ability to convert shaft power, or impeller power in the case of a direct driven fan, to air power. FEGs are based on fan peak (optimum) energy efficiency that indicates the quality of the fan energy usage and the potential for minimizing the fan energy usage.

Add new standard to Chapter 5 as follows:

AMCA

AMCA 205-12 Energy Efficiency Classification for Fans

Reason: The IECC Commercial Provisions do not currently have any provisions for fan efficiency. ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to address the minimum efficiency of air system fans.

C403.2.10 of the IECC Commercial Provisions addresses air system design and control and should be updated to include the criteria from ASHRAE Standard 90.1-2010 as enhanced by this addendum in order to retain technical compatibility between the IECC Commercial Provisions and standard 90.1. This change ensures continued consistency between the two documents.

Certified FEG ratings are calculated from test data taken during fan air-performance tests as part of routine participation in routine certified ratings program administered by AMCA International. Certified FEG ratings will not create a burden to designers and will not significantly increase cost of construction because dozens of fan manufacturers have already certified FEG ratings for hundreds of fan models.

Careful consideration has been given to the exceptions which are intended to provide relief for fans in certified packaged equipment, and fan types and sizes that do not easily conform to AMCA 205, or which, by virtue of their operating pressure, could lead to unwarranted incremental costs.

Cost Impact: The code change proposal will not significantly increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AMCA 205-2012 Energy Efficiency Classification for Fans, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.
Note: The term 'fan efficiency grade' is currently defined in the IgCC. The wording of this proposal is identical to the IgCC definition.

CE234-13

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

C403.2.10.3 (NEW)-EC-HICKMAN.doc

CE235 – 13
C403.2.10.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.10.1 Allowable fan ~~floor~~ horsepower. Each HVAC system at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) as shown in Table C403.2.10.1(1). This includes supply fans, <u>exhaust fans,</u> return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single *zone* variable-air-volume systems shall comply with the constant volume fan power limitation.

> **Exception<u>s</u>:** ~~The following fan systems are exempt from allowable fan floor horsepower requirement.~~
>
> 1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
> 2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less <u>are exempt from the allowable fan horsepower requirement</u>.

.

Reason: This proposal involves **e**ditorial clarification and simplification of provisions for allowable fan horsepower. The proposal inserts the words "exhaust fans" that are missing from C403.2.10.1, even though exception 2 is for exhaust fans and the definition for *fan system motor nameplate hp* referred to in the section include exhaust fans. The parent section is clear as to scope (fan horsepower) however the two exceptions have different basis. The first exception allows use of the less strict variable fan formula from the table for certain constant volume systems, while what is covered in the second exemption is a blanket exemption. It is appropriate to delete the introductory reason and provide the extent of exception separately for each exception. The term "floor" does not appear to be appropriate within the context of this section. The intent is to limit fan horsepower so the term floor is removed.

Cost Impact: The code change proposal does not increase the cost of construction.

CE235-13

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

C403.2.10.1-EC-WILLIAMS.doc

CE236 – 13
Table C403.2.10.1(2)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.10.1(2)
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
Credits	
Fully ducted return and/or exhaust air systems	0.5 inch w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 inch w.c.
Exhaust filters, scrubbers, or other exhaust treatment.	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 thru 12	0.5 inch w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 inch. w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition.
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.
Biosafety cabinet	Pressure drop of device at fan system design condition.
Energy recovery device, other than coil runaround loop	(2.2 × energy recovery effectiveness) – 0.5 inch w.c. for each airstream
Coil runaround loop	0.6 inch w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section <u>(fans serving spaces with design background noise goals below NC35)</u>	0.15 inch w.c.
Exhaust system serving fume hoods	0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet
<u>Deductions</u>	
<u>Systems without central cooling device</u>	<u>- 0.6 in. w.c.</u>
<u>Systems without central heating device</u>	<u>- 0.3 in. w.c.</u>
<u>Systems with central electric resistance heat</u>	<u>- 0.2 in. w.c.</u>

w.c. = water column
For SI: 1 inch w.c. = 249 Pa, 1 inch = 25.4 mm.

Reason: This proposal does the following:

1. Adds a requirement that the sound attenuation credit is only available if there are background noise criteria requirements.
2. Adds a deduction for systems without any central heating or cooling device. Since the base level fan power allowances include the assumption that those components are present, the deduction is warranted for those systems that do not include those component.
3. Adds a deduction for systems with electric resistance heating. Since the base level fan power allowances include the assumption that hydronic heating coils are present, systems with electric resistance heating coils that have less pressure drop do not need the full allowance assumed in the base level.

The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE236-13

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

C403.2.10.1(2)T-EC-FERGUSON.doc

CE237 – 13
C403.2.10.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.10.2 Motor nameplate horsepower. For each fan, the fan brake horse power shall be indicated on the construction documents and the selected motor shall be no larger than the first available motor size greater than the following: ~~brake horsepower. The fan brake horse power shall be indicated on the design documents to allow for compliance verification by the code official.~~

~~**Exceptions:**~~

1. For fans less than 6 bhp (4413 W), ~~where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~ 1.5 times the fan brake horsepower
2. For fans 6 bhp (4413 W) and larger, ~~where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~ 1.3 times the fan brake horsepower.

Reason: This proposal simplifies provisions for motor nameplate horsepower by replacing complicated exceptions with positive statements of what is required. The complex exceptions are replaced with a positive statement of what is required. This will reduce confusion over the maximum horsepower requirement and foster implementation and compliance verification.

Cost Impact: The code change proposal will not increase the cost of construction.

CE237-13

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

C403.2.10.2-EC-WILLIAMS.doc

CE238 – 13
C403.2.10.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.10.2 Motor nameplate horsepower. For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower (bhp). The fan brake horsepower (bhp) shall be indicated on the design documents to allow for compliance verification by the *code official*.

Exceptions:

1. For fans less than 6 bhp (4413 W), where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.
2. For fans 6 bhp (4413 W) and larger, where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.
3. <u>Systems complying with Section C403.2.10.1 *fan system motor nameplate hp* (Option 1).</u>

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to eliminate unnecessary documentation of fan bhp in certain cases. The change ensures continued consistency between the IECC Commercial Provisions and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE238-13

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

C403.2.10.2-EC-FERGUSON.doc

CE239 – 13

C403.2.12 (NEW), Table C403.2.12(1) (NEW), Table C403.2.12 (2) (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.12 Refrigeration equipment performance. Refrigeration equipment shall have an energy use in kWh/day not greater than the values of Tables C403.2.12(1) and C403.2.12(2) when tested and rated in accordance with AHRI Standard 1200. The energy use shall be verified through certification under an approved certification program or, where no certification program exists, the energy use shall be supported by data furnished by the equipment manufacturer.

TABLE C403.2.12(1)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATION

Equipment Type	**Application**	**Energy Use Limits (kWh per day)** [a]	**Test Procedure**
Refrigerator with solid doors	Holding Temperature	0.10 x V + 2.04	AHRI 1200
Refrigerator with transparent doors		0.12 x V + 3.34	
Freezers with solid doors		0.40 x V + 1.38	
Freezers with transparent doors		0.75 x V + 4.10	
Refrigerators/freezers with solid doors		the greater of 0.12 x V + 3.34 or 0.70	
Commercial refrigerators	Pulldown	0.126 x V + 3.51	

[a] V = volume of the chiller or frozen compartment as defined in AHAM-HRF-1

TABLE C403.2.12(2)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATORS AND FREEZERS

Equipment Type				**Energy Use Limits (kWh/day) as of 1/1/2012** [a,b]	**Test Procedure**
Equipment Class[c]	**Family Code**	**Operating Mode**	**Rating Temperature**		
VOP.RC.M	Vertical Open	Remote Condensing	Medium Temperature	0.82 × TDA + 4.07	AHRI 1200
SVO.RC.M	Semivertical Open	Remote Condensing	Medium Temperature	0.83 × TDA + 3.18	
HZO.RC.M	Horizontal Open	Remote Condensing	Medium Temperature	0.35 × TDA + 2.88	
VOP.RC.L	Vertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
HZO.RC.L	Horizontal Open	Remote Condensing	Low Temperature	0.57 × TDA + 6.88	
VCT.RC.M	Vertical Transparent Door	Remote Condensing	Medium Temperature	0.22 TDA + 1.95	

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012 [a,b]	Test Procedure
Equipment Class[c]	Family Code	Operating Mode	Rating Temperature		
VCT.RC.L	Vertical Transparent Door	Remote Condensing	Low Temperature	0.56 × TDA + 2.61	
SOC.RC.M	Service Over Counter	Remote Condensing	Medium Temperature	0.51 × TDA + 0.11	
VOP.SC.M	Vertical Open	Self Contained	Medium Temperature	1.74 × TDA + 4.71	
SVO.SC.M	Semivertical Open	Self Contained	Medium Temperature	1.73 × TDA + 4.59	
HZO.SC.M	Horizontal Open	Self Contained	Medium Temperature	0.77 × TDA + 5.55	
HZO.SC.L	Horizontal Open	Self Contained	Low Temperature	1.92 × TDA + 7.08	
VCT.SC.I	Vertical Transparent Door	Self Contained	Ice Cream	0.67 × TDA + 3.29	
VCS.SC.I	Vertical Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	
HCT.SC.I	Horizontal Transparent Door	Self Contained	Ice Cream	0.56 × TDA + 0.43	
SVO.RC.L	Semivertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
VOP.RC.I	Vertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
SVO.RC.I	Semivertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
HZO.RC.I	Horizontal Open	Remote Condensing	Ice Cream	0.72 × TDA + 8.74	
VCT.RC.I	Vertical Transparent Door	Remote Condensing	Ice Cream	0.66 × TDA + 3.05	
HCT.RC.M	Horizontal Transparent Door	Remote Condensing	Medium Temperature	0.16 × TDA + 0.13	
HCT.RC.L	Horizontal Transparent Door	Remote Condensing	Low Temperature	0.34 × TDA + 0.26	
HCT.RC.I	Horizontal Transparent Door	Remote Condensing	Ice Cream	0.4 × TDA + 0.31	
VCS.RC.M	Vertical Solid Door	Remote Condensing	Medium Temperature	0.11 × V + 0.26	
VCS.RC.L	Vertical Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	
VCS.RC.I	Vertical Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
HCS.RC.M	Horizontal Solid Door	Remote Condensing	Medium Temperature	0.11 × V + 0.26	
HCS.RC.L	Horizontal Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012 [a,b]	Test Procedure
Equipment Class[c]	Family Code	Operating Mode	Rating Temperature		
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
SOC.RC.L	Service Over Counter	Remote Condensing	Low Temperature	1.08 × TDA + 0.22	
SOC.RC.I	Service Over Counter	Remote Condensing	Ice Cream	1.26 × TDA + 0.26	
VOP.SC.L	Vertical Open	Self Contained	Low Temperature	4.37 × TDA + 11.82	
VOP.SC.I	Vertical Open	Self Contained	Ice Cream	5.55 × TDA + 15.02	
SVO.SC.L	Semivertical Open	Self Contained	Low Temperature	4.34 × TDA + 11.51	
SVO.SC.I	Semivertical Open	Self Contained	Ice Cream	5.52 × TDA + 14.63	
HZO.SC.I	Horizontal Open	Self Contained	Ice Cream	2.44 × TDA + 9.0	
SOC.SC.I	Service Over Counter	Self Contained	Ice Cream	1.76 × TDA + 0.36	
HCS.SC.I	Horizontal Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	

[a] V = Volume of the case, as measured in accordance with Appendix C of AHRI 1200.
[b] TDA = Total display area of the case, as measured in accordance with Appendix D of AHRI 1200.
[c] Equipment class designations consist of a combination (in sequential order separated by periods(AAA).(BB).(C)) of:

(AAA) An equipment family code where:
VOP=vertical open
SVO=semivertical open
HZO=horizontal open,
VCT=vertical transparent doors
VCS=vertical solid doors
HCT=horizontal transparent doors
HCS=horizontal solid doors
SOC=service over counter

(BB) An operating mode code, either
RC=remote condensing, or
SC=self-contained).

(C) A rating temperature code, either:
M=medium temperature (38 °F)
L=low temperature (0 °F), or
I=ice-cream temperature (15 °F).

For example, ''VOP.RC.M'' refers to the ''vertical open, remote condensing, medium temperature'' equipment class.

Add new standards to Chapter 5 as follows:

AHRI

1200-10 Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets.

AHAM

HRF-1 2007 Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to address energy efficiency opportunities available from commercial refrigeration and freezing equipment. In buildings where such equipment is located it contributes to the energy use of the building and now that there is a test procedure for efficiency of this equipment and minimum efficiencies are in standard 90.1-2010 it seems reasonable to include them in the IECC, noting this type of equipment is addressed in the IMC as to health and life safety. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AHRI 1200-2010 Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

A review of the standard proposed for inclusion in the code, AHAM-HRF-1-2007 Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE239-13

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

C403.2.12 (NEW) #1-EC-FERGUSON.doc

CE240 – 13
C202 (NEW), C403.2.12 (NEW), C403.2.13 (NEW), C403.5 (NEW), C403.5.1 (NEW), C403.5.2 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.12 Walk-in Coolers and Walk-in Freezers. Site assembled or site constructed *walk-in coolers* and *walk-in freezers* shall comply with the following:

1. Automatic door closers shall be provided that fully close walk-in doors that have been closed to within 1 inch of full closure.

   Exception: Closers are not required for doors over 3 feet 9 inches wide or 7 feet tall.

2. Doorways shall be provided with strip doors, curtains, spring-hinged doors, or other method of minimizing infiltration when the doors are open.

3. Walls shall be provided with insulation having a thermal resistance of not less than R–25, ceilings shall be provided with insulation having a thermal resistance of not less than R–25 and doors of *walk-in coolers* and *walk –in freezers* shall be provided with insulation having a thermal resistance of not less than R–32.

   Exception: Insulation is not required for glazed portions of doors or at structural members associated with the walls, ceiling or door frame.

4. The floor of *walk-in freezers* shall be provided with insulation having a thermal resistance of not less than R–28.

5. Evaporator fan motors that are less than 1 horsepower and less than 460 volts shall be electronically commutated motors or 3-phase motors.

6. Light sources shall have an efficacy of not less than 40 lumens per Watt, including any ballast losses or shall be provided with a device that automatically turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer* was last occupied.

7. Transparent reach-in doors for and windows in opaque walk-*in freezer* doors shall be provided with triple-pane glass having the interstitial spaces filled with inert gas or provided with heat-reflective treated glass.

8. Transparent reach-in doors for and windows in opaque *walk-in cooler* doors shall be double-pane heat-reflective treated glass having the interstitial space gas filled;

9. Anti-sweat heaters that are not provided with anti-sweat heater controls shall have a total door rail, glass, and frame heater power draw not greater than 7.1 Watts per square foot of door opening for *walk-in freezers*, and not greater than 3.0 Watts per square foot of door opening for *walk-in coolers*.

10. Anti-sweat heater controls shall be capable of reducing the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

11. Condenser fan motors that are less than 1 horsepower in capacity shall be of the electronically commutated or permanent split capacitor-type or shall be 3-phase motors.

    Exception: Fan motors in *walk-in coolers* and *walk-in freezers* combined in a single enclosure greater than 3,000 square feet in floor area are exempt.

C403.2.13 Refrigerated display cases. Site assembled or site constructed refrigerated display cases shall comply with the following:

1. Lighting in refrigerated display cases and glass doors installed on walk-in coolers and freezers shall be controlled by one of the following;

    1.1 Automatic time switch controls to turn off lights during non-business hours. Timed overrides for display cases or walk-in coolers and freezers may be used to turn the lights on for up to one hour and shall automatically time out to turn the lights off.

    1.2 Motion sensor controls on each display case or walk-in door section that reduce lighting power by at least 50 percent within 3 minutes after the area within the sensor range is vacated. how about is 'unoccupied' as you have used in other proposals.

2. All low temperature display cases shall incorporate temperature based defrost termination control with a time limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.

3. Anti-sweat heater controls shall reduce the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

C403.5 Refrigeration systems Refrigerated display cases, *walk-in coolers* or *walk-in freezers* that are served by remote compressors and remote condensers not located in a *condensing unit*, shall meet the requirements of Section C403.5.and C403.5.2.

Exception: Systems where the working fluid in the refrigeration cycle goes through both subcritical and supercritical states (transcritical) or systems that use ammonia refrigerant are exempt.

C403.5.1 Condensers serving refrigeration systems. Fan-powered condensers shall comply with the following:

1. The design *saturated condensing temperatures* for air-cooled condensers shall not exceed the design dry bulb temperature plus 10°F for *low temperature refrigeration systems*, and the design dry bulb temperature plus 15°F for *medium temperature refrigeration systems* where the *saturated condensing temperature* for blend refrigerants shall be determined using the average of liquid and vapor temperatures as converted from the condenser drain pressure

2. Condenser fan motors that are less than 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.

3. All condenser fans for air-cooled condensers, evaporatively cooled condensers, air or water cooled fluid coolers or cooling towers shall reduce fan motor demand to no more than 30% of design wattage at 50% of design air volume, and incorporate one of the following continuous variable speed fan control approaches:

    3.1 Refrigeration system condenser control for air-cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature.

3.2 Refrigeration system condenser control for evaporatively cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient wetbulb temperature.

4. Multiple fan condensers shall be controlled in unison.

5. The minimum condensing temperature setpoint shall be no greater than 70˚F.

C403.5.2 Compressor systems. Refrigeration compressor systems shall comply with the following:

1. Compressors and multiple-compressor systems suction groups shall include control systems that use floating suction pressure control logic to reset the target suction pressure temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

   Exception. Controls are not required for the following:

   1. Single compressor systems that do not have variable capacity capability.

   2. Suction groups that have a design saturated suction temperature of 30˚F or higher, suction groups that comprise the high stage of a two-stage or cascade system or suction groups that primarily serve chillers for secondary cooling fluids.

2. Liquid sub-cooling shall be provided for all low temperature compressor systems with a design cooling capacity equal to or greater than 100,000 Btu/hr with a design saturated suction temperature of -10˚F or lower. The sub-cooled liquid temperature shall be controlled at a maximum temperature setpoint t of 50˚F at the exit of the sub-cooler using either compressor economizer (inter-stage) ports or a separate compressor suction group operating at a saturated suction temperature of 18˚F or higher.

   2.1 Insulation for liquid lines with a fluid operating temperature less than 60˚F are shall comply with Table C403.2.8.

3. All compressors that incorporate internal or external crankcase heaters shall provide a means to cycle the heaters off during compressor operation.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

BUBBLE POINT. The refrigerant liquid saturation temperature at a specified pressure

CONDENSING UNIT. A factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. The unit consists of one or more refrigerant compressors, refrigerant condensers (air-cooled, evaporatively – cooled, and/or water-cooled), condenser fans and motors (where used) and factory-supplied accessories.

REFRIGERANT DEW POINT. The refrigerant vapor saturation temperature at a specified pressure.

REFRIGERATION SYSTEM, LOW TEMPERATURE. Systems for maintaining food product in a frozen state in refrigeration applications.

REFRIGERATION SYSTEM, MEDIUM TEMPERATURE. Systems for maintaining food product above freezing in refrigeration applications.

SATURATED CONDENSING TEMPERATURE. The saturation temperature corresponding to the measured refrigerant pressure at the condenser inlet for single component and azeotropic refrigerants, and the arithmetic average of the dew point and *bubble point* temperatures corresponding to the refrigerant pressure at the condenser entrance for zeotropic refrigerants.

WALK-IN COOLER. An enclosed storage space less than 3,000 square feet in floor area, designed to maintain the space warmer than 32°F but cooler than 55°F that has a ceiling height of not less than 7 feet

WALK-IN FREEZER. An enclosed storage space less than 3,000 square feet in floor area, designed to maintain the space at no greater than 32°F that has a ceiling height of not less than 7 feet

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to address the energy efficiency associated with refrigeration systems and coolers. These systems and equipment are prevalent in many building types and should be addressed in the IECC because they represent an opportunity to save additional energy. The change ensures continued consistency between the IECC and standard 90.1.

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

CE240-13

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

C403.2.12 (NEW) #2-EC-FERGUSON.doc

CE241 – 13

C403.1, C403.3, C403.3.1.1 (NEW), C403.1.1.1, C403.3.3.1.1.2, C403.3.1.2 (NEW), C403.3.1.1.3, Table C403.3.1.1(1), Table C403.3.1.1.3(2), C403.3.1.1.4, C403.3.1.4 (NEW), C403.3.1.4.1 (NEW), C403.3.1.4.2 (NEW), C403.3.2, C403.4 through C403.4.3.5

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Section C403.2 (referred to as the mandatory provisions) and ~~either:~~ <u>shall comply with Sections C403.3 and C403.4 based on the equipment and systems provided.</u>

~~1. Section C403.3 (Simple systems); or~~
~~2. Section C403.4 (Complex systems).~~

C403.3 ~~Simple HVAC systems and equipment~~ <u>Economizers</u> (Prescriptive). This section applies to buildings served by ~~unitary or packaged~~ HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8). ~~, each serving one *zone* and controlled by a single thermostat in the *zone* served. It also applies to two-pipe heating systems serving one or more *zones*, where no cooling system is installed~~

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).

<u>**C403.3.1.1 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.</u>

<u>**Exceptions:**</u>

1. <u>Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.</u>
2. <u>Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.</u>

C403.3.1.2 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.

> **Exception:** Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

TABLE C403.3.1(2)
EQUIPMENT EFFICIENCY
PERFORMANCE EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

~~**C403.3.1.1**~~ **C403.3.1.3 Air economizers.** Air economizers shall comply with Sections ~~C403.3.1.1.1 through C403.3.1.1.4~~. C403.3.1.3.1 through C403.3.1.3.4.

~~**C403.3.1.1.1**~~ **C403.3.1.3.1 Design capacity.** Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

~~**C403.3.1.1.2**~~ **C403.3.1.3.2 Control signal.** Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

> **Exception:** The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-*zone* systems).

~~**C403.3.1.1.3.**~~ **C403.3.1.3.3 High-limit shutoff.** Air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table ~~C403.3.1.1.3(1)~~ C403.3.1.3.3(1). High-limit shutoff control settings for these control types shall be those specified in Table ~~C403.3.1.1(2)~~ C403.3.1.3.3(2).

TABLE ~~C403.3.1.1(1)~~ C403.3.1.3.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1A, 2A, 3A, 4A	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	—

a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.

TABLE ~~C403.3.1.1.3(2)~~C403.3.1.3.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	$T_{OA} > 75°F$	Outdoor air temperature exceeds 75°F
	5A, 6A, 7A	$T_{OA} > 70°F$	Outdoor air temperature exceeds 70°F
	All other zones	$T_{OA} > 65°F$	Outdoor air temperature exceeds 65°F
Differential dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	All	$h_{OA} > 28$ Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the “A” setpoint curve[b]
Differential enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceedsreturn air enthalpy
Dew-point and dry bulb temperatures	All	$DP_{OA} > 55°F$ or $T_{OA} > 75°F$	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

For SI: °C = (°F - 32) × 5/9 , 1 Btu/lb = 2.33 kJ/kg.

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50-percent relative humidity. As an example, at approximately 6,000 feet elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

b. Setpoint “A” corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40-percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

~~C403.3.1.1.4~~ **C403.3.1.3.4 Relief of excess outdoor air.** Systems shall be capable of relieving excess *outdoor air* during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

C403.3.1.4 Water-side economizers. Water-side economizers shall comply with Sections C403.3.1.4.1 through C403.3.1.4.2

C403.3.1.4.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.

> **Exception:** Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).

C403.3.1.4.2 Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (noneconomizer) mode.

~~**C403.3.2 Hydronic system controls.** Hydronic systems of at least 300,000 Btu/h (87 930 W) design output capacity supplying heated and chilled water to comfort conditioning systems shall include controls that meet the requirements of Section C403.4.3.~~

C403.4 ~~Complex~~ Hydronic and multi-zone HVAC system controls and equipment. (Prescriptive). This section applies to buildings served by HVAC equipment and systems not covered in Section C403.3. Hydronic and multi-zone HVAC system controls and equipment shall comply with this section.

~~**C403.4.1 Economizers.** Economizers shall comply with Sections C403.4.1.1 through C403.4.1.4.~~

~~**C403.4.1.1 Design capacity.** Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.~~

> ~~**Exception:** Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).~~

~~**C403.4.1.2 Maximum pressure drop.** Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (noneconomizer) mode.~~

~~**C403.4.1.3 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.~~

> ~~**Exceptions:**~~
>
> 1. ~~Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.~~

~~2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.~~

~~**C403.4.1.4 Economizer heating system impact.** HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.~~

> ~~**Exception:** Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.~~

~~**C403.4.2**~~ <u>**C403.4.1**</u> **Variable air volume (VAV) fan control.** Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:

1. Driven by a mechanical or electrical variable speed drive;
2. Driven by a vane-axial fan with variable-pitch blades; or
3. The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

~~**C403.4.2.1**~~ <u>**C403.4.1.1**</u> **Static pressure sensor location.** Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2. For sensors installed down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

~~**C403.4.2.2**~~ <u>**C403.4.1.2**</u> **Set points for direct digital control.** For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

~~**C403.4.3**~~ <u>**C403.4.2**</u> **Hydronic systems controls.** The heating of fluids that have been previously mechanically cooled and the cooling of fluids that have been previously mechanically heated shall be limited in accordance with Sections ~~C403.4.3.1 through C403.4.3.3~~ <u>C403.4.2.1 through C403.4.2.3</u>. Hydronic heating systems comprised of multiple-packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers. Hydronic heating systems comprised of a single boiler and greater than 500,000 Btu/h (146 550 W) input design capacity shall include either a multistaged or modulating burner.

~~**C403.4.3.1**~~ <u>**C403.4.2.1**</u> **Three-pipe system.** Hydronic systems that use a common return system for both hot water and chilled water are prohibited.

~~**C403.4.3.2**~~ <u>**C403.4.2.2**</u> **Two-pipe changeover system.** Systems that use a common distribution system to supply both heated and chilled water shall be designed to allow a dead band between changeover from one mode to the other of at least 15°F (8.3°C) outside air temperatures; be designed to and provided with controls that will allow operation in one mode for at least 4 hours before changing over to the other mode; and be provided with controls that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F (16.7°C) apart.

~~**C403.4.3.3**~~ <u>**C403.4.2.3**</u> **Hydronic (water loop) heat pump systems.** Hydronic heat pump systems shall comply with Sections ~~C403.4.3.3.1~~ <u>C403.4.2.3.1,</u> through ~~C403.4.3.3.3~~ <u>C403.4.2.3.2</u>.

~~**C403.4.3.3.1**~~ <u>**C403.4.2.3.1**</u> **Temperature dead band.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (11.1°C) between initiation of heat rejection and heat addition by the central devices.

Exception: Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on realtime conditions of demand and capacity, dead bands of less than 20°F (11°C) shall be permitted.

~~C403.4.3.3.2~~ C403.4.2.3.2 Heat rejection. Heat rejection equipment shall comply with Sections ~~C403.4.3.3.2.1 and C403.4.3.3.2.2~~. C403.4.2.3.2.1 and C403.4.2.3.2.2

Exception: Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.

~~C403.4.3.3.2.1~~ C403.4.2.3.2.1 Climate Zones 3 and 4. For climate zones 3 and 4:

1. If a closed-circuit cooling tower is used directly in the heat pump loop, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided.
2. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.
3. If an open- or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

~~C403.4.3.3.2.2~~ C403.4.2.3.2.2 Climate Zones 5 through 8. For Climate Zones 5 through 8, if an open- or closed-circuit cooling tower is used, then a separate heat exchanger shall be provided to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.

~~C403.4.3.3.3~~ C403.4.2.3.3. Two position valve. Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.

~~C403.4.3.4~~ C403.4.3.3 Part load controls. Hydronic systems greater than or equal to 300,000 Btu/h (87 930 W) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have the capability to:

1. Automatically reset the supply-water temperatures using zone-return water temperature, building-return water temperature, or outside air temperature as an indicator of building heating or cooling demand. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; or
2. Reduce system pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or control valves designed to modulate or step down, and close, as a function of load, or other *approved* means.

~~C403.4.3.5~~ C403.4.3.4 Pump isolation. Chilled water plants including more than one chiller shall have the capability to reduce flow automatically through the chiller plant when a chiller is shut down. Chillers piped in series for the purpose of increased temperature differential shall be considered as one chiller.

Boiler plants including more than one boiler shall have the capability to reduce flow automatically through the boiler plant when a boiler is shut down.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:

2012C has multiple conflicts:

a. Air economizer only applied to simple systems.
b. Water systems and references to “cooling” within the Simple System language (C403.3.1)
c. Directing language that should apply to all economizer types was only under Complex (Integrated economizer, economizer control, relief of outdoor air). This language moved to Section 403.3.1 (basic economizer requirements, which requires either air or water economizers).
d. Section C403.3.2, Hydronic system controls (under Simple Systems) references “chilled water”, which is not a simple system. This same language is duplicated under Section C403.4.3.4 (Part Load controls). All hydronic controls are combined under this proposal to be under the retitled Section “C403.4 ~~Complex~~ Hydronic and multi-zone HVAC systems controls and equipment. (Prescriptive)”. Any special multi-zone or hydronic requirements (formerly complex system) are under this section.
e. A complex system could have air and water economizers. Where exceptions apply becomes a complicated process.
f. Language in Section 403.3 (simple systems), includes references to Tables C403.2.3(1) through C403.2.3(8), which includes all equipment, including centrifugal chillers and cooling towers (always part of a complex system).

Complex and simple systems do not have a use in the IECC. These systems have no definitions. There are no other references to these systems anywhere else in the IECC. The need for these divisions in the IECC is no longer necessary and only leads to confusion and/or conflicting code requirements as noted in this proposal.

The intent of this proposal is to do the following:

1. An Economizer section with general requirements for all economizers in the same location. Requirements for Air and Water economizers are outlined. Exceptions are the same for either economizer type.
2. Complex Systems becomes a general prescriptive section for hydronic and multiple zone systems and the control of these systems.

A key element to making the revised provisions work, is revision to Section 403.1. As it stands in the 2012 code, Section 403.1 has a serious flaw that allows you to pick and choose a compliance path by saying “use either simple or complex” path requirements. The language is an “either A or B”. It does not have a path to use both simple and complex when you have a building with both equipment types. It also allows cherry-picking of a path.

Section 403.1 does NOT require that a chilled water systems use the complex system Section 403.4 control/pump requirements. It can pick the Section 403.3 simple system path. A building can install an air economizer on a 100 ton (chilled water) VAV rooftop and not have to meet ANY of the requirements of Section 403.4 for VAV systems… And since an air economizer is included with most every VAV rooftop, that creates a gaping hole in code. And very little applies code will apply to a boiler or chiller you may have on the site.

Cost Impact: The 2012 code was flawed and the result would be inconsistent application of the economizer provisions. Because the 2012 does state specifically that an economize is required for complex systems, this could be viewed as an increase to the cost of construction. However since the energy savings envisioned by the balance of the HVAC requirements would not be realized without an installed economizer, most systems would be provided with one (or more) anyway.

CE241-13

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

C403.1-EC-THOMPSON-SEHPCAC

CE242 – 13
C403.3.1, C403.4.1, C403.4.1.1

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station (shirleyellis@tamu.edu)

Revise as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air ~~or water~~ economizer meeting the requirements of Sections C403.3.1.1 ~~through C403.3.1.1.4~~ or a water economizer meeting the requirements of Section C403.4.1.1.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).

C403.4.1. Economizers. ~~Economizers shall comply with Sections C403.4.1.1 through C403.4.1.4.~~ Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Section C403.3.1.1 or a water economizer meeting the requirements of Section C403.4.1.1.

C403.4.1.1 Water economizers. Water economizer systems shall comply with Sections C403.4.1.1.1 through C403.4.1.1.4 .

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).

~~**C403.4.1.1**~~ **C403.4.1.1.1 Design capacity.** Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50^{o}F dry bulb (10^{o}C dry bulb)/45^{o}F wet bulb(7.2^{o}C wet bulb) and below.

~~**Exception:** Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).~~

~~**C403.4.1.2**~~ **C403.4.1.1.2 Maximum pressure drop.** (No change to text)

~~**C403.4.1.3**~~ **C403.4.1.1.3 Integrated economizer control** (No change to text)

~~**C403.4.1.4**~~ **C403.4.1.1.4 Economizer heating system impact.** (No change to text)

Table C407.5.1(1)
Specifications for the Standard Reference and Proposed Designs

Cooling systems	Fuel Type: same as proposed design	As proposed
	Equipment type[c]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(1), C403.2.3(20 and C403.2.3(3)	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer[d]: same as proposed, in accordance with Sections C403.3.1 or C403.4.1	As proposed

d. If an economizer is required in accordance with Table C403.3.1(1), and if no economizer exists or is specified in the proposed design, then a supply air economizer shall be provided in accordance with Section ~~C403.4.1~~ C403.3.1.1.

(Portions of Table not shown remain unchanged)

Reason: The 2012 IECC addresses air or water economizers for simple HVAC systems, but only water economizer systems for Complex HVAC systems. In addition, all the requirements for design capacity, control signals, high-limit shutoff and relief of excess outdoor air for air economizers is currently contained in the simple HVAC systems with no cross reference in the complex HVAC system section.

This proposal contains no new language, the change proposed to requirements for air economizers in the section for simple HVAC systems and the requirements for water economizers in the complex HVAC systems and cross reference the two. It also adds a reference for air economizers to the Total Building Performance Specification Table C407.5.1(1)

The change to Table C407.5.1(1) footnote d is to correct the Section reference to Air economizers.

Cost Impact: This code change proposal will not increase the cost of construction.

CE242-13

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

C403.3.1-EC-ELLIS.doc

CE243 – 13

C403.3.1, Table C403.3.1(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.3 Simple HVAC systems and equipment (Prescriptive). This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8), each serving one *zone* and controlled by a single thermostat in the *zone* served. It also applies to two-pipe heating systems serving one or more *zones*, where no cooling system is installed.

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

~~1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).~~
1. In cooling systems for buildings located in climate zones 1A and 1B.
2. In climate zones other than 1A and 1B, where individual cooling units have a capacity of less than 33,000 Btu/h. The total supply capacity of all fan-cooling units not provide with economizers shall not exceed 20 percent of the total supply capacity of all fan-cooling units in the building nor 300,000 Btu/h, whichever is greater.
~~2.~~ 3. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
~~3.~~ 4. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
~~4.~~ 5. Systems expected to operate less than 20 hours per week.
~~5.~~ 6. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
~~6.~~ 7. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).

~~TABLE C403.3.1(1)~~
~~ECONOMIZER REQUIREMENTS~~

~~CLIMATE ZONES~~	~~ECONOMIZER REQUIREMENT~~
~~1A, 1B~~	~~No requirement~~
~~2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8~~	~~Economizers on all cooling systems ≥ 33,000 Btu/h[a]~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.~~

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.
Reasons for this specific proposal:

The interaction between exception #1 and Table C403.3.1(1) is unclear. The exception states where economizers are not to be required, but the table appears to be a listing of economizer requirements. The intent is unclear as written. The proposal replaces the table with 2 exceptions which are clearly exceptions from an economizer requirement. The first exception addresses climate zones 1A and 1B where no economizers are required regardless of the system capacity. The second exception addresses the other climate zones currently covered by the last line of the table and the footnote. Similar revision was made to the Massachusetts Stretch Code to address the confusion of this section and table.

The same format occurs in a parallel section in the IgCC. If this proposal is successful, the SEHPCAC will submit a companion proposal in 2014 for the IgCC.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will have no impact on the cost of construction.

CE243-13

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

C403.3.1-EC-THOMPSON-SEHPCAC

CE244 – 13
C403.3.1, Table C403.3.1(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).
7. Systems under 110,000 Btu/h total cooling capacity that utilize multiple stage cooling capacity control and multiple speed fan control.

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ~~≥ 33,000~~ ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:

The current trigger values for economizers are in conflict with current ASHRAE Standard 90.1. The modification to the 2012 IECC was based on the Green standard 189.1 additional energy measures; prescriptive requirements should not come from an optional code or standard. ASHRAE 90.1 reduced their trigger to 54,000 Btu/h in the 2010 version and is not decreasing the trigger in any addenda for the 2013 version. Intent is to align the code and standard. For 2013, California Title 24 revisited economizers and did not drop their trigger value below 54,000 Btu/h. No other mandatory code or standard has reduced below 54,000 Btu/h.

The first part of this proposal recommends matching Table C403.3.1(1) to the trigger to other codes and standards.

The second part of this proposal allows for one additional exception: small units (under 110,000 Btu/h) are not required to have an economizer if the units have multiple speed fans and multiple stage cooling capacity.

For this proposal, the efficiency measure is similar to a prescriptive requirement that California added for small units. We are proposing an exception to economizers for small units. As part of the 2013 California Title 24 proposals, multiple stage compressor and fan control for small HVAC units (under the current 110,000 Btu/h trigger for multiple speed fans) was economically viable as a prescriptive measure and was included in Title 24.

http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/HVAC/2013_CASE_NR_Fan_Control_Integrated_Economizers_Sept_2011.pdf has the complete report. Taylor Engineering performed the energy modeling. They report a possible 2-year payback for addition of multi-speed compressor & fan.

Per cost figures furnished to California by Dick Lord of Carrier, this proposed exception would be less than or equal to the cost of an economizer. So there is no cost impact.

Oregon BCD energy modeling used the Taylor Engineering baseline concept. We looked at the same building with these small HVAC units. We compared a building without economizers (not required in California for the HVAC size range) with the same units with economizer and with just the multi-speed configuration. Adding multi-speed configuration saves nearly 4-times more energy than adding an economizer.

So the proposed exception not only has an equal or lower cost, it will save a greater amount of energy.

Additional study performed by PNNL of economizers and other measures for small packaged HVAC equipment provides additional insight. PNNL Study #PNNL-20995 (http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20955.pdf), even though relative to retrofit of existing equipment, gives insight on the relative effectiveness of economizers, multi-speed control and Demand Control Ventilation (DCV). Multi-speed control is a more effective conservation measure than an economizer. See page 37:

- Multi-speed fan control and DCV are the two control strategies that contribute most to the HVAC energy savings. Specifically, multi-speed fan control dominates the impact in a small number of cases, including all four building types in Miami and the small office building in Houston, Phoenix and Los Angeles. DCV dominates the impact for all other cases. The multi-speed fan contribution to savings can be negative in cold climates (e.g, Duluth and Fairbanks for all building types).

- Adding an air-side economizer after multi-speed fan control does not have a large impact on HVAC energy savings except for a few cases, such as the small office building in Los Angeles. In comparison with a nonintegrated economizer, the integrating economizer has negligible impact on HVAC energy savings.

Overall, this proposal provides both alignment with other standards and codes and is an improvement in energy conservation for anyone taking the new exception path.

So we are basing a request for modifying the levels on additional analysis conducted by Oregon Building Codes Division.

The analysis methods referenced for this proposal use the same energy models developed by ASHRAE and the Department of Energy (PNNL) for the Final Determination of ASHRAE 90.1-2010 in the Federal Register. We used the US DOE prototype energy model files and EnergyPlus software. NO new models were used; the simulation software was the same. Weighting of building types was the same as used by PNNL. Only buildings from the 90.1 determination that have packaged HVAC units in this size range were considered (not office buildings with VAV units). See these studies by PNNL for the analysis:

1. For the description for the modeling method http://www.energycodes.gov/sites/default/files/documents/BECP_Energy_Cost_Savings_STD2010_May2011_v00.pdf
2. The DOE certification of 90.1-2010 (references the linked PNNL-20405 above) http://www.energycodes.gov/sites/default/files/documents/BECP_FinalQuantitativeAnalysisReport901-2010Determination_Oct2011_v00.pdf

The national weighted-average annual energy savings per economizer for systems between 33,000 Btu/h and 110,000 Btu/h is $41 per year per economizer. Using a first cost of $750/economizer (including installation, set-up, initial testing) and a 15-year life cycle, economizers never provide a return on the cost premium, much less recover the cost of maintenance. On the basis of these models, we feel the trigger levels should be re-examined. Weighting of life cycle costs were based on EIA national average utility costs, 15-year life cycle and 3% discount rate for the $750 average first cost and $50/year for maintenance.

The table below is the raw data of savings per economizer by building type and climate zone. Weighting used the same data from the DOE/PNNL studies. Green highlights show over $85/year, which <u>might</u> cover first costs and maintenance.

ANNUAL SAVINGS PER ECONOMIZER (RAW DATA)

BUILDING PROTOTYPE/ CLIMATE ZONE	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	6A	6B	7	8
Fast Food Restaurant					$ 65		$ 135	$ 94		$ 87		$ 82	$ 69	$ 38
Small Hotel	$ 109	$ 123	$ 128	$ 108		$ 85		$ 80	$ 80	$ 67	$ 82		$ 63	
Strip Mall Retail	$ 18	$ 26	$ 16	$ 41	$ 76	$ 22	$ 32	$ 75	$ 29	$ 50	$ 54	$ 58	$ 37	$ 31
Strip Mall Office	$ 18	$ 4	$ 11	$ 23		$ 26	$ 34	$ 33	$ 25	$ 29	$ 35	$ 32	$ 28	$ 23
Warehouse	$ 11	$ (14)	$ 9	$ 10		$ 0	$ (1)	$ (3)		$ (2)	$ (3)	$ (4)		$ (3)
Stand Alone Retail	$ 76	$ 99	$ 96	$ 105	$ 210	$ 102	$ 152	$ 130	$ 99	$ 122	$ 123	$ 134	$ 126	$ 119
Primary School	$ 31	$ 35	$ 31	$ 39	$ 105	$ 42	$ 57	$ 48	$ 41	$ 49	$ 42	$ 135	$ 160	$ 163

When looking at the Life Cycle Costs by building type, there is not a return on investment. And this simulation considers a perfectly functioning economizer. If the weighting were to include a factor for non-functioning economizers, becomes difficult to justify any economizer below 110,000 Btu/h.

WEIGHTED LIFE CYCLE COST BY BUILDING TYPE

BUILDING TYPE	FAST FOOD	SMALL HOTEL	STRIP MALL	SMALL OFFICE	WAREHOUSE	STAND-ALONE RETAIL	PRIMARY SCHOOL
WEIGHTED LCC	($288)	($201)	($1,014)	($1,097)	($1,286)	($128)	($875)

Buildings are more efficient due to improvements in the codes. Contributing reasons why these systems no longer viable at the current triggers:

1. Improvements to the building envelope: glazing improvements reduce solar gain; envelope insulation delays thermal conductivity gains.
2. Reduced lighting power: 30-45% reductions from 2006 levels.
3. Equipment efficiency improvements: 30% increase in SEER requirement for 60,000 Btu/h (5-ton) units and smaller.

With less cooling required during the year (the building is more efficient), there is a smaller "pool of energy use" to reduce with this measure. And because of the improved building characteristics, there are fewer hours where cooling needs overlap with outdoor conditions suitable for economizer operation. An economizer on units in this size range has little chance of paying back its cost premium during the life cycle of the unit. The effects of code improvements over the years could not be analyzed without a full energy model. And the DOE/PNNL files are among the best available and are used by DOE for analyzing 90.1.

The current 33,000 Btu/h trigger (thru 110,000 Btu/h) only returns its cost over the life of the equipment when there are either high load conditions (computer closets) or nearly continuous operation (18-24 hours per day, 7-days per week). And positive returns are only found in a few climate zones, not on a national weighting by building type. The 33,000 Btu/h figure should only remain if there are exceptions for smaller units with operating hours of under 112 hours per week (above the 20 hour per week exception already in code) or if there are high internal loads. But this is difficult to put into enforceable code language.

We propose to match the current 90.1-2010 level of 54,000 Btu/h; 90.1 is not considering any further revisions below this level. The weighted average economizer savings increases slightly closer to a level where it might pay back.

Cost Impact: The code change proposal will not increase the cost of construction.

CE244-13

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

C403.3.1(1)T-EC-THOMPSON-SEHPCAC

CE245 – 13
C403.3.1, Table C403.3.1(1), C403.3.1.4, C4033.1.1.5 (NEW), Table C403.3.1.1.3(2), C403.3.1.2 (NEW), C403.3.1.2.1 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through ~~C403.3.1.1.4.~~ C403.3.1.1.5.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve residential spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.3.1(2).
7. Systems that include a heat recovery system in accordance with Section C403.4.6.
8. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and *infiltration* loads, is not more than the transmission and *infiltration* losses at an outdoor temperature of 60°F.

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ ~~33,000~~ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

C403.3.1.1.4 Dampers. Return, exhaust/relief, and outdoor air dampers shall in accordance with Section C402.4.5.2

C403.3.1.1.5 Relief of excess outdoor air. Systems shall be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

TABLE C403.3.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN): EQUATION	DESCRIPTION
Fixed dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > 75°F$	Outdoor air temperature exceeds 75°F
	~~5A, 6A, 7A~~	$T_{OA} > 70°F$	Outdoor air temperature exceeds 70°F
	~~All other zones~~	~~$T_{OA} \geq 65°F$~~	~~Outdoor air temperature exceeds 65°F~~
Differential dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	~~All~~ 2A, 3A, 4A, 5A, 6A	$h_{OA} > 28$ Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" setpoint curve[b]
Differential enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceeds return air enthalpy
Dew-point and dry bulb temperatures	All	$DP_{OA} > 55°F$ or $T_{OA} > 75°F$	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

For SI: °C = (°F - 32) × $^5/_9$, 1 Btu/lb = 2.33 kJ/kg.

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50-percent relative humidity. As an example, at approximately 6,000 feet elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40-percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

C403.3.1.2 Water economizers. Water economizers shall comply with Sections C403.3.1.2.1 through C403.3.1.2.2.

C403.3.1.2.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at outdoor air temperatures not greater than 50°F dry bulb/45°F wet bulb.

Exceptions:

1. Systems primarily serving computer rooms in which 100 percent of the expected system cooling load at 40°F dry bulb/35°F wet bulb is met with evaporative water economizers.
2. Systems primarily serving computer rooms with dry cooler water economizers which satisfy 100 percent of the expected system cooling load at 35°F dry bulb.
3. Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/45°F wet bulb and where 100 percent of the expected system cooling load at 45°F(7°C) dry bulb/40°F (4°C) wet bulb is met with evaporative water economizers.

C403.3.1.2.2 Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet of water (45 kPa) or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

Reason: This proposal makes the air economizer requirements consistent with ANSI/ASHRAE/IES Standard 90.1. Quite a bit of collaboration has gone into this proposal to achieve consensus, and is a result of many years of research investigating the cost effectiveness of economizer use in each climate zone.

In addition, new requirements for water economizers are being added.

Cost Impact: The code change proposal will not increase the cost of construction.

CE245-13

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

C403.3.1-EC-FERGUSON.doc

CE246 – 13

C202 (NEW), Table C403.3.1.1.3(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C403.3.1.1.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1A, 2A, 3A, 4A	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	—

~~a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.~~

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

<u>**ELECTRONIC ENTHALPY CONTROLLER.** A device that uses a combination of humidity and dry bulb temperature in its switching algorithm.</u>

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The footnote is a definition of a device. It provides no information that enhances the enforcement of the table other than defining one of the pieces of equipment. Chapter 2 is the preferred location for definitions. If this is approved, the SEHPCAC will submit a companion code change in 2014 to address parallel provisions in the IgCC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE246-13

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

C403.3.1.3(1)T-EC-THOMPSON-SEHPCAC

CE247 – 13
C403.3.1.1, C403.3.1.1.5 (NEW)

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C403.3.1.1 Air economizers. Air economizers shall comply with Sections C403.3.1.1.1 through ~~C403.3.1.1.4~~ C403.3.1.1.5.

C403.3.1.1.5 Economizer dampers. Dampers used in economizers shall comply with the requirements of Section C402.4.5.2.

Reason: This change will ensure that economizer intake dampers are low-leakage, and that the low-leakage ratings are certified to ensure the design intent and energy savings. Having them labeled will also make this provision easier to enforce.

This is a companion change to the proposal we submitted to C402.4.5.2 Outdoor air intakes and exhausts.

Cost Impact: The code change proposal will not increase the cost of construction.

CE247-13

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

C403.3.1.1-EC-HICKMAN.doc

CE248 – 13
C403.4.1

Proponent: Gerald Anderson, City of Overland Park, KS, representing self
(jerry.anderson@opkansas.org)

Revise as follows:

C403.4.1 Economizers. ~~Economizers shall comply with~~ Each cooling system that has a fan shall include either an air or water economizer complying with Sections C403.4.1.1 through C403.4.1.4

Reason: The purpose of this code change is to place a charging statement within the body of the code. As the code is currently written, there is no requirement for economizers in Complex HVAC systems and equipment.

Cost Impact: The code change proposal will not increase the cost of construction.

CE248-13

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

C403.4.1-EC-ANDERSON.doc

CE~~________~~249 – 13

C403.4.1, Table C403.4.1(NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.4.1 Economizers. ~~Economizers shall comply with~~ Each cooling system shall include either an air economizer in compliance with Section C403.3.1.1 or water economizer in compliance with Sections C403.4.1.1 through C403.4.1.4.

Exceptions: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1) that either:
   1.1. Have direct expansion cooling coils, or
   1.2. Where the total chilled water system capacity less the capacity of fan units with air economizers is less than the minimum listed in Table C403.4.1.
2. Chilled-water cooling systems that are passive (without a fan) or use induction where the total chilled water system capacity less the capacity of fan units with air economizers is less than the minimum listed in Table C403.4.1.
3. Individual cooling units that are in compliance with exceptions 2 through 6 to economizers under Section C403.3.1.

TABLE C403.4.1
MINIMUM CHILLED WATER SYSTEM COOLING CAPACITY FOR DETERMINING ECONOMIZER COOLING REQUIREMENTS~~Minimum Chilled Water System Cooling Capacity for Determining Economizer Cooling Requirements~~

Climate Zones (Cooling)	**Total Chilled Water System Capacity Less Capacity of Cooling Units with Air Economizers**	
	Local Water-Cooled Chilled Water Systems	**Air-cooled Chilled Water Systems or District Chilled Water Systems**
1a	No economizer requirement	No economizer requirement
1b, 2a, 2b	960,000 Btu/h (280 kW)	1,250,000 Btu/h (365 kW)
3a, 3b, 3c, 4a, 4b, 4c	720,000 Btu/h (210 kW)	940,000 Btu/h (275 kW)
5a, 5b, 5c, 6a, 6b, 7, 8	1,320,000 Btu/h (385 kW)	1,720,000 Btu/h (505 kW)

Reason: This proposal improves cooling efficiency by requiring a water-side economizer for non-fan systems (e.g. radiant cooling, passive chilled beam systems), and for systems with small individual fan systems served by chilled water systems at least 50 tons in size. Such systems include fan coil units, radiant cooling systems, and chilled beam cooling systems.

During part-load cooling situations, cooling towers can be used to provide chilled water to meet cooling load. This technology can apply to small individual fan systems served by chilled water and to non-fan systems such as radiant cooling and passive chilled beam systems. There are a number of approaches to meeting the proposed requirements: (1) a separate closed circuit cooling tower (evaporative fluid cooler) that pre-cools chilled water return before it enters the chiller that is sized to meet the requirements of section C403.4.1.1, (2) an integrated operation with return chilled water precooled by the chiller tower and then completely cooled by the chiller, or (3) an either/or approach, where the chilled water is generated by the tower until load can no longer be met and then only the chiller is used. To analyze cost effectiveness, option 1 was analyzed, as it is most straightforward, and has clearly defined cost boundaries.

There is a cost impact associated with this proposed change since a heat exchanger or more expensive closed-circuit cooling tower and additional pipes, pumps, and controls will typically be required. A cost effectiveness analysis found that with reduced chiller operation the requirement for the waterside economizer was cost effective. Based on a system life of 22 years, a discounted cost effective payback threshold is 13.1 years. The simple paybacks in all of the climate zones where waterside economizers would be required under this proposal are well below this cost effective threshold.

References:

R. Hart. 2012. *Supporting Analyses for proposed changes to the commercial provisions of the 2012 IECC: Water-side Economizer for Non-Fan Cooling Systems.*
http://www.energycodes.gov/development/commercial/2015IECC

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

CE249–-13

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

C403.4.1-EC-WILLIAMS.doc

CE250 – 13

C403.4.1.3, Table C403.4.1.3 (NEW), C403.4.2.1 (NEW), Table C403.4.2.1 (NEW), C403.4.2.1, C403.4.2.2, C403.4.7

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.1.3 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not be capable of creating a false load the mechanical cooling systems by limiting or disabling the economizer or any other means, such as hot gas bypass except at the lowest stage of mechanical cooling.

Units that include an air economizer shall comply with the following:

1. Unit controls shall have the mechanical cooling capacity control interlocked with the air economizer controls such that the outdoor air damper is at the 100 percent open position when *mechanical cooling* is on and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45^{o}F.
2. DX units that control 75,000 Btu/h or greater of rated capacity of the capacity of the mechanical cooling directly based on occupied space temperature shall have no fewer than 2 stages of mechanical cooling capacity
3. All other DX units including those that control space temperature by modulating the airflow to the space shall be in accordance with Table C403.4.1.3

~~**Exceptions:**~~

~~1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.~~
~~2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.~~

TABLE C403.4.1.3
DX COOLING STATESTAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS

Rating Capacity	Minimum Number of Mechanical Cooling Stages	Minimum Compressor Displacement[a]
≥65,000 Btu/h and <240,000 Btu/h	3 stages	≤35% of full Load
≥240,000 Btu/h	4 stages	≤25% full load

a. For *mechanical cooling* stage control that does not use variable compressor displacement the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

C403.4.2 ~~Variable air volume (VAV)~~ fan control. ~~Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:~~

~~1. Driven by a mechanical or electrical variable speed drive;~~
~~2. Driven by a vane-axial fan with variable-pitch blades; or~~

~~3. The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data~~

C403.4.2.1 Fan airflow control Each cooling system listed in Table C403.4.2.1 shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements.

1. DX and chilled water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have no fewer than 2 stages of fan control. Low or minimum speed shall not exceed 66 percent of full speed. At low or minimum speed the fan system shall draw no more than 40 percent of the fan power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation only operation.

2. All other units including DX cooling units and chilled water units that control the space temperature by modulating the airflow to the space shall have modulating fan control. Minimum speed shall not exceed 50 percent of full speed. At minimum speed the fan system shall draw no more than 30 percent of the power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation only operation.

3. Units that include an airside economizer to meet the requirements of Section C403.3.1 shall have no fewer than of 2 speeds of fan control during economizer operation

   Exceptions:

   1. Modulating fan control is not required for chilled water and evaporative cooling units with fan moters of less than 1 HP where the units are not used to provide *ventilation air* and the indoor fan cycles with the load.

   2. Where the volume of outdoor air required to meet the *ventilation* requirements of the *International Mechanical Code* at low speed exceeds the air that would be delivered at the speed defined in Section C403.4.2 then the minimum speed shall be selected to provide the required *ventilation air*.

TABLE C403.4.2.1
EFFECTIVE DATES FOR FAN CONTROL

Cooling System Type	**Fan Motor Size**	**Mechanical Cooling Capacity**
DX Cooling	any	≥75,000 Btu/h (before 1/1/2016)
		≥65,000 Btu/h (after 1/1/2016
Chilled Water and Evaporative cooling	≥5 HP	Any
	≥1/4 HP	Any

~~C403.4.2.1~~ **C403.2.2 VAV Static pressure sensor location.** Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2. For sensors installed down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

~~C403.4.2.2~~ **C403.4.2.3 VAV Set points for direct digital control.** For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

C403.4.7 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated in Table C403.4.7 as limited by Section C403.4.1.3

> ~~**Exception:** Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (26 379 W).~~

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, does not contain the exceptions that are shown in the IECC. Those exceptions were in standard 90.1-2007 but were removed in standard 90.1-2010. The change ensures continued consistency between the IECC and standard 90.1-2010.

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

CE250-13

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

C403.4.1.3-EC-FERGUSON.doc

CE251 – 13
C403.4.2.1, C403.4.2.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.2.1 Static pressure sensor location. Static pressure sensors used to control VAV fans shall be ~~placed in a position~~ located such that the controller setpoint is no greater than ~~one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2~~ 1.2 inches w.c. ~~For sensors~~ Where this results in one or more sensors being ~~installed~~ located down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

C403.4.2.2 Set points for direct digital control. For systems with direct digital control of individual ~~*zone* boxes~~ zones reporting to the central control panel, the static pressure set point shall be reset based on the zone requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open. The direct digital controls shall be capable of monitoring zone damper positions; or shall have an alternative method of indicating the need for static pressure which is capable of all of the following:

1. Automatically detecting any zone which excessively drives the reset logic;
2. Generating an alarm to the system operational location; and
3. Allowing an operator to readily remove one or more zones from the reset algorithm.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised with respect to controls for certain aspects of HVAC systems. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will increase the cost of construction where controls will now be required.

CE251-13

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

C403.4.2.1-EC-FERGUSON.doc

CE252 – 13
C403.4.3.3.2, C403.4.3.3.2.1, C403.4.3.3.2.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.3.3.2 Heat rejection. For heat pump systems ~~Heat rejection equipment~~ ~~shall comply with Sections C403.4.3.3.2.1 and C403.4.3.3.2.2.~~ in Climate Zones 3 through 8:

1. Where a closed-circuit cooling tower is used directly in the heat pump loop, one of the following shall be provided:.
   1.1 An automatic valve capable of providing a bypass to all but a minimal flow of water around the tower; or
   1.2 Low leakage positive closure dampers.
2. Where an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed capable of providing a bypass of all heat pump water flow around the tower.
3. Where an open-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be capable of being controlled by shutting down the circulation pump on the cooling tower loop.

Exception: Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.

~~**C403.4.3.3.2.1 Climate Zones 3 and 4.** For Climate Zones 3 and 4:~~

1. ~~If a closed-circuit cooling tower is used directly in the heat pump loop, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided.~~
2. ~~If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.~~
3. ~~If an open- or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.~~

~~**C403.4.3.3.2.2 Climate Zones 5 through 8.** For Climate Zones 5 through 8, if an open- or closed-circuit cooling tower is used, then a separate heat exchanger shall be provided to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.~~

Reason: For consistency with ASHRAE/IES 90.1-2010. . As that standard is an alternative path to compliance with the IECC and there is a desire to maintain equivalency of the IECC with 90.1 the issue of energy use for freeze protection systems must also be addressed in the IECC. These requirements for heat pump heat loss have been in 90.1 for a few years. This change will bring the requirements in line with 90.1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE252-13

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

C403.4.3.3.2-EC-FERGUSON.doc

CE253 – 13
C403.4.3.4

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com

Revise as follows:

C403.4.3.4 Part load controls. Hydronic systems greater than or equal to ~~300,000~~ 500,000 Btu/h (87 930W) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have the capability to:

1. Automatically reset the supply-water temperatures in response to varying building heating and cooling demand using: coil valve position, zone-return water temperature, building-return water temperature, or out-side air temperature ~~as an indicator of building heating or cooling demand~~. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; ~~or~~ and
2. Automatically vary fluid flow for hydronic systems with a combined motor capacity of 10 hp (7.5 kW) or larger with three or more ~~Reduce systems pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or~~ control valves or other devices by reducing the system design flow rate by at least 50 percent by designed valves that modulate or step open ~~down,~~ and close, or pumps that modulate or turn on and off as a function of load ~~or other approved means~~; and
3. Automatically vary pump flow on chilled water systems and heat rejection loops serving water cooled unitary air-conditioners with a combined motor capacity of 10 hp (7.5 kW) or larger by reducing ~~system~~ pump design flow by at least 50 percent ~~of design flow rate~~ utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off ~~or control valves designed to modulate or step down, and close, as a function of load, or other *approved* means.~~ Pump flow shall be controlled to maintain one control valve nearly wide open or to satisfy the minimum differential pressure.

Exceptions:

1. Supply-water temperature reset for chilled water systems supplied by offsite district chilled water or chilled water from ice storage systems.
2. Minimum flow rates other than 50 percent as required by the equipment manufacturer for proper operation of equipment where using flow bypass or end-of-line 3-way valves.
3. Variable pump flow on dedicated equipment circulation pumps where configured in primary / secondary design to meet minimum flow requirements required by the equipment manufacturer for proper operation of equipment,

Reason: It's recommended this code section is revised for the following reasons:

Increase Hydronic System Capacity Threshold: This proposal recommends the current 300,000 Btu/h (25 tons) hydronic system capacity threshold is increased to 500,000 Btu/h (42 tons). As shown in the table below, these capacities represent small building sizes (~ 20,000 sqft) which generally are not served by hydronic heating and cooling systems. For example, a hydronic system serving the minimum capacity would have a circulation pump of only 1 or 2 HP. Supply water temperature reset has small energy benefits on small hydronic systems relative to the added control costs and complexity. The 500,000 Btu/h capacity also aligns with boilers requiring a multistage or modulating burner controls, see section C403.4.3.

Hyrdonic System Capacity Btu/h	Equivalent Capacity in Tons	Estimate of Building Size - Sqft		
		Eff Bldg	Std Bldg	Less Eff Bldg
		20 Btuh / Sqft	25 Btuh / Sqft	30 Btuh / Sqft
300,000	25.0	15,000	12,000	10,000
500,000	41.7	25,000	20,000	16,667
750,000	62.5	37,500	30,000	25,000
1,000,000	83.3	50,000	40,000	33,333

Requirements Additive and Not Mutually Exclusive: The requirements shouldn't exclude one another, but should add to each other. As currently written only one of the following control requirements need to be implemented. With the revised code language and added exceptions, all three of the following control requirements should be implemented.

- Supply Water Temperature Reset
- Variable Flow Control
- Variable or Stepped Pumping

Variable flow control (requirement 2) in hydronic systems is needed in order to implement variable or stepped pumping (requirement 3). Therefore requirement 2 is defined prior to requirement 3. Requirement 2 applies to all other hydronic systems since 2-way valve control is less expensive than 3-way valve control. This requirement also aligns with section C403.3.3.3, which requires 2-way valve control on heat pump hydronic systems.

Cooling System Variable Flow or Stepped Pumping: Cooling systems with pump capacity 10hp or greater should have variable flow using variable speed drives or stepped pumping. Allowing cooling pumps to vary flow and ride the pump curve should not be allowed on larger pumping systems. Heating only hydronic systems of any size are excluded from this requirement since pump inefficiencies are recaptured as a heat source in the hydronic heating system. A cost effective analysis, as shown in the table below, indicates cooling systems with a pump capacity of 10HP to be cost effective. The analysis assumes an average pump run time of 2000 hours. This is thought to be a conservative chilled water pump run time from a national prospective. This analysis only accounts for pump motor energy savings and doesn't account for the reduced heat rejected from the cooling pump into the chilled water system.

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

CE253-13

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

C403.4.3.4-EC-MAKELA.doc

CE254 – 13
C202 (NEW), C403.4.3.5 (NEW), Table C403.4.3.5 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.3.5 Boiler Turndown. *Boiler systems* with design input of greater than 1,000,000 Btu/h shall comply with the turndown ratio specified in Table 403.4.3.5.

The system turndown requirement shall be met through the use of multiple single input boilers, one or more *modulating boilers* or a combination of single input and modulating boilers.

TABLE 403.4.3.5
BOILER TURNDOWN

Boiler System Design Input (Btu/h)	Minimum Turndown Ratio
≥ 1,000,000 and less than or equal to 5,000,000	3 to 1
> 5,000,000 and less than or equal to 10,000,000	4 to 1
> 10,000,000	5 to 1

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

BOILDER, MODULATING. A boiler that is capable of more than a single firing rate in response to a varying temperature or heating load.

BOILER SYSTEM. One or more boilers, their piping and controls that work together to supply steam or hot water to heat output devices remote from the boiler.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to include boiler turndown requirements for boilers larger than 1,000,000 Btu/h. These requirements are in addition to the efficiency requirements in TABLE C403.2.8. The change ensures continued consistency between the IECC and Standard 90.1-2010.

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

CE254-13

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

C403.4.3.5-EC-FERGUSON.doc

CE255 – 13

C403.4.4, C403.4.4.1 (NEW), C403.4.4.2 (NEW), C403.4.4.2.1 (NEW), C403.4.4.2.2 (NEW), C403.4.4.3, C403.4.4.4 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.4 Heat rejection equipment ~~fan speed control.~~ Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

> **Exception:** Factory-installed heat rejection devices within HVAC equipment tested and rated in accordance with Tables C403.2.3(6) and C403.2.3(7).

C403.4.4.1 General. Heat rejection equipment such as air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers, and evaporative condensers used for comfort cooling applications shall comply with this section.

> **Exception:** Heat rejection devices whose energy usage is included in the equipment efficiency ratings listed in Tables C403.2.3 (6) and C403.2.3 (7).

C403.4.4.2 Fan speed control. The fan speed shall be controlled as follows:

C403.4.4.2.1 Fan motors at least 7.5 hp. Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

> **Exceptions:** The following fan motors over 7.5 hp are exempt:
>
> 1. Condenser fans serving multiple refrigerant circuits.
> 2. Condenser fans serving flooded condensers.
> 3. Installations located in climate zones 1 and 2.

C403.4.4.2.2 Multiple cell heat rejection equipment. Multiple cell heat rejection equipment with variable speed fan drives shall:

1. Be controlled to operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components, and
2. Be controlled so all fans can operate at the same fan speed required for the instantaneous cooling duty as opposed to staged (on/off) operation.

Minimum fan speed shall be the minimum allowable speed of the fan drive system in accordance with the manufacturer's recommendations.

C403.4.4.3 Limitation on centrifugal fan open-circuit cooling towers. Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1100 gpm or greater at 95°F condenser water return, 85°F condenser water supply, and 75°F outdoor air wet-bulb temperature shall meet the energy efficiency requirement for axial fan open-circuit cooling towers listed in Table C403.2.3(8).

> **Exception:** Centrifugal open-circuit cooling towers that designed with inlet or discharge ducts or require external sound attenuation.

C403.4.4.4 Tower flow turndown. Open circuit cooling towers used on water cooled chiller systems that are configured with multiple or variable speed condenser water pumps shall be designed so that all open circuit cooling tower cells can be run in parallel with the larger of the flow that is produced by the smallest pump at its minimum expected flow rate or at 50 percent of the design flow for the cell.

Reason: ASHRAE/IES Standard 90.1, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to enhance the provisions applicable to cooling tower controls and supports further reductions in energy use. The change ensures continued consistency between the IECC and 90.1.

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

CE255-13

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

C403.4.4-EC-FERGUSON.doc

CE256– 13
C403.4.5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.5 Requirements for complex mechanical systems serving multiple zones. Sections C403.4.5.1 through C403.4.5.3 shall apply to complex mechanical systems serving multiple zones. Supply air systems serving multiple zones shall be VAV systems which, during periods of occupancy, are designed and capable of being controlled to reduce primary air supply to each *zone* to one of the following before reheating, recooling or mixing takes place:

1. Thirty percent of the maximum supply air to each *zone*.
2. Three hundred cfm (142 L/s) or less where the maximum flow rate is less than 10 percent of the total fan system supply airflow rate.
3. The minimum ventilation requirements of Chapter 4 of the *International Mechanical Code.*
4. <u>Any higher rate that can be demonstrated to reduce overall system annual energy use by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake for the system, as *approved* by the *code official*.</u>

Exception: The following define where individual *zones* or where entire air distribution systems are exempted from the requirement for VAV control:

1. *Zone*s where special pressurization relationships or cross-contamination requirements are such that VAV systems are impractical.
2. *Zones* or supply air systems where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.
3. *Zones* where special humidity levels are required to satisfy process needs.
4. *Zones* with a peak supply air quantity of 300 cfm (142 L/s) or less and where the flow rate is less than 10 percent of the total fan system supply airflow rate.
5. *Zones* where the volume of air to be reheated, recooled or mixed is no greater than the volume of outside air required to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.
6. *Zones* or supply air systems with thermostatic and humidistatic controls capable of operating in sequence the supply of heating and cooling energy to the *zones* and which are capable of preventing reheating, recooling, mixing or simultaneous supply of air that has been previously cooled, either mechanically or through the use of economizer systems, and air that has been previously mechanically heated.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, contains an important exception to zone minimum airflow that is not included in the IECC. The exception is important to allow optimization of multi-zone system ventilation, and saves significant energy nationally. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE256-13

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

C403.4.5 #1-EC-FERGUSON.doc

CE257 – 13
C403.4.5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferuson@ashrae.org)

Revise as follows:

C403.4.5 Requirements for complex mechanical systems serving multiple zones. Sections C403.4.5.1 through C403.4.5.3 shall apply to complex mechanical systems serving multiple zones. Supply air systems serving multiple zones shall be VAV systems which, during periods of occupancy, are designed and capable of being controlled to reduce primary air supply to each *zone* to one of the following before reheating, recooling or mixing takes place:

1. Thirty percent of the maximum supply air to each *zone*.
2. Three hundred cfm (142 L/s) or less where the maximum flow rate is less than 10 percent of the total fan system supply airflow rate.
3. The minimum ventilation requirements of Chapter 4 of the *International Mechanical Code.*
4. Any higher rate that can be demonstrated to reduce overall system annual energy use by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake for the system, as *approved* by the *code official*.
5. The air flow rate required to comply with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.

Exception: The following define where individual *zones* or where entire air distribution systems are exempted from the requirement for VAV control:

~~1.~~ ~~*Zones* where special pressurization relationships or cross-contamination requirements are such that VAV systems are impractical.~~

~~2.~~ 1. *Zones* or supply air systems where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.

~~3.~~ 2. *Zones* where special humidity levels are required to satisfy process needs.

~~4.~~ 3. *Zones* with a peak supply air quantity of 300 cfm (142 L/s) or less and where the flow rate is less than 10 percent of the total fan system supply airflow rate.

~~5.~~ 4. *Zones* where the volume of air to be reheated, recooled or mixed is no greater than the volume of outside air required to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.

~~6.~~ 5. *Zones* or supply air systems with thermostatic and humidistatic controls capable of operating in sequence the supply of heating and cooling energy to the *zones* and which are capable of preventing reheating, recooling, mixing or simultaneous supply of air that has been previously cooled, either mechanically or through the use of economizer systems, and air that has been previously mechanically heated.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, contains an important exception to zone minimum airflow that is not included in the IECC. The exception is important to allow optimization of multi-zone system ventilation, and saves significant energy nationally. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: The code change proposal will not increase the cost of construction.

CE257-13

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

C403.4.5 #2-EC-FERGUSON.doc

CE258 – 13
C403.4.5.4 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.5.4 Fractional HP fan motors. Motors for fans that are 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent rated in accordance with DOE 10 CFR 431 . These motors shall also have the means to adjust motor speed for either balancing or remote control. The use of belt-driven fans to sheave adjustments for airflow balancing in lieu of a varying motor speed shall be permitted.

> **Exception** Motors in the airstream within fan-coils and terminal units that only provide heating to the space served.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, contains an important exception to zone minimum airflow that is not included in the IECC. Research conducted by the Califronia Energy Commission and others indicates that Electronically Commutated Motors (ECM) are more efficient and are cost effective compared to standard (e.g. PSC) motors in applications where the fan runs many hours per day (e.g. toilet exhaust fans, series fan-powered VAV boxes, and fan-coil units) other than those in the airstream that operate only when heating a space since the motor in that case behave essentially as an electric resistance heater. ECMs also reduce energy because their speed can be adjusted for balancing rather than throttling dampers. (ECMs can also be used for variable speed capacity control but that is not a requirement of this section.). The change ensures continued consistency between the IECC and standard 90.1-2010.

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

CE258-13

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

C403.4.5.4 (NEW)-EC-FERGUSON.doc

CE259 – 13
C403.4.5.5 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.5.5 Multiple-zone VAV system ventilation optimization control. Multiple-zone VAV systems with direct digital control of individual zone boxes reporting to a central control panel shall have automatic controls configured to reduce outdoor air intake flow below design rates in response to changes in *system ventilation efficiency* (E_v) as defined by the *International Mechanical Code*.

Exceptions:

1. VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan-powered terminal units.
2. Systems having exhaust air energy recovery complying with Section C403.2.6.
3. Systems where total design exhaust airflow is more than 70 percent of total design outdoor air intake flow requirements.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has requirements for ventilation optimization control on VAV systems that are not included in the IECC. These provisions provide significant energy savings. The change ensures continued consistency between the IECC and standard 90.1-2010 and provides significant energy savings in IECC.

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

CE259-13

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

C403.4.5.5 (NEW)-EC-FERGUSON.doc

CE260 – 13
C403.4.8 (New)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.8 Window switch controls. Any conditioned space with operable wall or roof openings to the outdoors shall be provided with controls that, when any such opening is open:

1. Disable mechanical heating or reset the heating set point to 55°F or lower.
2. Disable mechanical cooling or reset the cooling set point to 90°F or greater unless the outside air temperature is below the conditioned space temperature

   Exceptions: These controls are not required for:

   1. Building entries with automatic closing devices
   2. Any space without a thermostat
   3. Alterations to existing buildings

Reason: When a space with operable windows has non-integrated mechanical heating and cooling, it is likely that annual HVAC energy will be increased when compared to the same space without operable windows. This can be attributed to operable windows being left open when conditions are not favorable, resulting in high infiltration loads on the HVAC system. There are many reasons why windows are opened when conditions are not favorable:

1. Occupant wants more fresh air and is inconsiderate or unaware of the energy penalty of opening the window when indoor/outdoor conditions are not favorable. This is particularly likely when the HVAC system has sufficient capacity to maintain the space indoor temperature at setpoint despite the increased infiltration load.
2. Occupant does not have sufficient information regarding the indoor air temperature, outdoor air temperature, or HVAC mode of operation to properly determine if opening the window will reduce or increase energy use.
3. Occupant opened the window during favorable conditions, but left the room while the window was open. During their time away from the space, the conditions transitioned to unfavorable.

The intent of this measure is to reduce unnecessary use of energy for heating or cooling of additional un-tempered air if an operable window is left open outside of times when it is beneficial to leave it open. This is accomplished with a simple mechanical switch that integrates the HVAC system operation with operable window position.

The change ensures continued consistency between the IECC and Standard 90.1-2010.

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

CE260-13

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

C403.4.8-EC-FERGUSON.doc

CE261 – 13
C403.4.8 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Add new text as follows:

C403.4.8 Limitation of air-cooled cooling. Buildings with more than 3,600,000 Btu/h (300 tons, 85 kW) total cooling capacity supplied by chilled water shall not have more than 1,200,000 Btu/h (100 tons, 30 kW) provided by air-cooled chillers.

Exceptions:

1. Where the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled chillers as approved by the *code official*.
2. Where chillers are used to charge a thermal energy storage system with a design temperature of less than 40°F (4°C).
3. Air-cooled chillers with IPLV ratings 12 percent greater than efficiencies required by Section C403.2.3 or Section C406.2, whichever is used.

Reason: The goal of this proposal is to require buildings with 300 tons or greater peak cooling load to have no more than 100 tons served by air‑cooled systems. Include exceptions for high-efficiency air-cooled systems and systems with thermal storage.

Water-cooled chillers are significantly more efficient than air-cooled chillers, using about 30 percent less energy. Once cooling capacity reaches a certain size, it is reasonable to install the more complex water-cooled chiller equipment. The code change proposal limits the capacity of air-cooled chillers in larger chilled water plants.

This proposal places a limit on capacity of less efficient equipment in the prescriptive path. As such it does not limit the ability to use such equipment, as the reasonable and cost effective efficiency gains in this proposal can be made up through trade off in the performance path in other energy using areas of the building if there is a desire or need to install air-cooled equipment above the prescriptive capacity limits.

Where an air cooled chiller is desired, exception 3 allows higher efficiency units to be used. A review of available equipment shows that at least two manufacturers have equipment that can meet the 12% greater IPLV required in the exception for all sizes and a third manufacturer meets that threshold for half the available models.

There would be a cost increase associated with this code change for buildings with chiller plants larger than 300 tons in capacity that are not subject to the exceptions because those buildings currently do not require more complex water-cooled systems. A detailed cost analysis conducted in support of similar provisions for the 2005 version of California Title 24 (the California energy code) found that this requirement was cost effective. In this analysis, the limitation was cost effective in San Francisco, a climate with one of the lowest national ratios of total cooling use to cooling design temperature. If the Net Present Value results for Fresno are de-rated to 40% to account for larger cooling tower sizing and higher airflows in humid climates due to higher wet bulb design temperatures, they would be still be cost effective in moist climates like Houston, Memphis, and Miami.

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

CE261-13

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

C403.4.8 (NEW)-EC-MAKELA.doc

CE262-13
Table C404.2, C404.2.1 (New)

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

Revise as follows:

TABLE C404.2
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED [a,b]	TEST PROCEDURE
Water heaters, electric	≤ 12 kW[d]	Resistance	0.97 - 0.00 132*V*, EF	DOE 10 CFR Part 430
	> 12 kW	Resistance	~~1.73*V*+ 155 SL, Btu/h~~ (0.3 + 27/V_m), %/h	ANSI Z21.10.3
	≤ 24 amps and ≤ 250 volts	Heat pump	0.93 - 0.00 132*V*, EF	DOE 10 CFR Part 430
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal	0.59 - 0.0019*V*, EF	DOE 10 CFR Part 430
	≥ 105,000 Btu/h	< 4,000 Btu/h/gal	~~78%~~ 80% E_t $(Q/800 + 110\sqrt{V})$SL, Btu/h	ANSI Z21.10.3
Heat pump pool heaters	All	50ºF dry bulb and 44.2ºF wet bulb outdoor air and 80.0ºF entering water	4.0 COP	AHRI 1160

b. Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation, *Q* is the nameplate input rate in Btu/h. ~~and~~ In the ~~SL~~ equations for electric water heaters, *V* is the rated volume in gallons and *Vm* is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, *V* is the rated volume in gallons.
d. Electric water heaters with an input rating of 12kW or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating greater than 12kW.

(Portions of Table not shown remain unchanged)

C402.2.1 High input-rated service water heating systems. This section shall apply only to gas fired water heating equipment installed in new buildings. Where a singular piece of water heating equipment serves the entire building and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall have a thermal efficiency, E_t, of not less than 90 percent. Where multiple pieces of water heating equipment serve the building and the combined input rating of the water heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, E_t, shall be not less than 90 percent.

Exceptions:

1. Where 25 percent of the annual *service water heating* requirement is provided by site-solar or site-recovered energy, the minimum thermal efficiency requirements of this section shall not apply.

2. The input rating of water heaters installed in individual dwelling units shall not be required to be included in the total input rating of *service water heating* equipment for a building.

3. The input rating of water heaters with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of *service water heating* equipment for a building.

Reason: This proposal adds requirement for the use of gas condensing service water heaters in newly constructed buildings. Additionally, the proposed addendum makes several changes to Table C404.2 to reflect current Federal energy regulations for electric water heaters, to match the requirements of the newest edition ASHRAE 146 heat pump pool heater standard and to increase the minimum efficiency for certain oil storage water heaters from 78 to 80 percent. This makes the IECC consistent with 90.1.

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

CE262-13

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

C404.6(NEW)-EC-FERGUSON.DOC

CE263-13
Table C404.2

Proponent: Jennifer. Hatfield, J. Hatfield & Associates, PL representing Association of Pool & Spa Professionals (APSP) (jhatfield@apsp.org)

Revise as follows:

TABLE C404.2
MINIMUM PEFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED[a,b]	TEST PROCEDURE
Pool heaters, gas and oil	All	--	~~78~~ 82% E_t	ASHRAE 146

(Portions of Table not shown remain unchanged)

Reason: Per federal Department of Energy requirements, the minimum efficiency level for pool gas heaters went from 78% to 82%, effective April 2013. This change ensures consistency with federal requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

CE263-13

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

404.2T-EC-HATFIELD.DOC

CE264 – 13
C404.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C404.2 Service water-heating equipment performance. Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through data furnished by the manufacturer of the equipment or through certification under an *approved* certification program. Water heating equipment also intended to be used to provide space heating shall meet the applicable provisions of Table C404.2.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has a provision to address the efficiency of equipment used to provide both space heating and service water heating functions. This situation is not addressed in the IECC and needs to be to ensure consistency between standard 90.1-2010 and the IECC.

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

CE264-13

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

C404.2-EC-FERGUSON.doc

CE265-13
C404.2 (NEW)

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

Add new text as follows:

<u>**C404.2 Equipment and system sizing**. The output capacity of service water heating equipment and systems shall not exceed the loads calculated by the system designer.</u>

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to require service hot water system sizing. The change ensures continued consistency between the IECC and standard 90.1-2010.

Cost Impact: This code change proposal will not increase the cost of construction.

CE265-13

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

C404.2 (NEW)-EC-FERGUSON.DOC

CE266-13
C404.3

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

Revise as follows:

C404.3 Temperature controls. ~~Service water-heating equipment shall be provided with controls to allow a setpoint of 110°F (43°C) for equipment serving dwelling units and 90°F (32°C) for equipment serving other occupancies.~~ The outlet temperature of lavatories in public facility rest rooms shall be limited to 110°F (43°C).

Reason: While there may be some energy saving reasons for having controls on service water heating equipment that limit the output temperature of the water, the temperatures chosen are right in the "sweet spot" that enables pathogens, such as Legionella, to multiply exceedingly. These provisions encourage unsafe hot water distribution systems and should be removed.

Cost impact: The code change proposal will not increase the cost of construction.

CE266-13

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

C404.3 #2-EC-KLEIN

CE267-13
C404.3

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

Revise as follows:

C404.3 Temperature controls. Service water-heating equipment shall be provided with controls to allow a setpoint of 110°F (43°C) for equipment serving dwelling units and 90°F (32°C) for equipment serving other occupancies. ~~The outlet temperature of lavatories in public facility rest rooms shall be limited to 110°F (43°C).~~

Reason: The International Plumbing Code already has the requirement for limiting the temperature of water discharged from "public" lavatory fixture fitting (See IPC Section 416.5 below). This is more a safety issue than it is an energy savings issue. The plumbing code also requires that the temperature of the water be controlled by a temperature limited device (a thermostatic mixing valve) that complies with ASSE 1070 or CSA B125.3. Simply setting a water heater thermostat to 110F is not an acceptable method for controlling temperature at the lavatory outlet. Having this temperature requirement in this section of the IECC implies that setting a water heater thermostat to control the water temperature for the public lavatories is acceptable which is not the case!

Also, there is some confusion about what constitutes a "public facility restroom" – it is not a defined term. The plumbing code has been dealing with the right way to specify what lavatories need the temperature control. Let the plumbing code continue to deal with the intricacies of this requirement and remove this sentence from the IECC so that conflicts do not occur.

2012 IPC Section 416.5 for reference:

> **416.5 Tempered water for public hand-washing facilities.** *Tempered water* shall be delivered from lavatories and group wash fixtures located in public toilet facilities provided for customers, patrons and visitors. *Tempered water* shall be delivered through an *approved* water-temperature limiting device that conforms to ASSE 1070 or CSA B125.3.

Cost impact: The code change proposal will not increase the cost of construction.

CE267-13

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

C404.3 #1-EC-KLEIN

CE268-13
C404.3, C404.5, C404.6

Proponent: Jennifer. Hatfield, J. Hatfield & Associates, PL representing Association of Pool & Spa Professionals (APSP) (jhatfield@apsp.org)

Revise as follows:

C404.3 Temperature controls. Service water-heating equipment shall be provided with controls to allow a setpoint of 110°F (43°C) for equipment serving dwelling units and 90°F (32°C) for equipment serving other occupancies. The outlet temperature of lavatories in public facility rest rooms shall be limited to 110°F (43°C). <u>This section shall not apply to pool heaters.</u>

C404.5 Pipe insulation. For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K). The first 8 feet (2438 mm) of piping in non-hot water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 ×K). <u>This section shall not apply to piping associated with pool heaters.</u>

> **Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).

C404.6 Hot water system controls. Circulating hot water system pumps or heat trace shall be arranged to be turned off either automatically or manually when there is limited hot water demand. Ready access shall be provided to the operating controls. <u>This section shall not apply to pool heaters.</u>

Reason: The requirements of these sections were never intended to apply to pool heaters. But pool heaters, by the fact that they are indicated in Table C404.2 SERVICE WATER HEATING EQUIPMENT, are service water heating equipment. Pool heaters operate at different temperatures and the temperatures maximums are covered by the International Swimming Pool and Spa Code. Insulating pool piping to these requirements is futile as the pool itself radiates far more heat that the piping loses. Controls for pool pumps (circulating pumps) are already regulated by the International Swimming Pool and Spa Code. The added lines of text in these sections solves the problems.

Cost impact: The code change proposal will not increase the cost of construction.

CE268-13

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

C404.3-EC-HATFIELD.DOC

CE269-13
C404.3 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C404.3 Hot water meters required. In buildings of Group R2 occupancy having apartments that are served by a centralized service hot water system for the building, the hot water service pipe to each apartment shall have a water meter. Such water meters shall meet the technical requirements for customer billing purposes. The meters shall not be required to be located within the apartments.

Reason: The purpose of this proposal is to save energy. Apartment residents use less hot water when they are individually billed for their usage.

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

CE269-13

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

C404.8 (NEW)-EC-NOGLER.doc

CE270-13
C404.5, IPC [E] 607.5

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE IECC COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THE COMMITTEE.

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

PART I-IECC-COMMERCIAL PROVISIONS

Delete and substitute as follows:

~~**C404.5 Pipe insulation.** For Automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/ m2 × K). The first 8 feet (2438 mm) of piping in non-hot water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

> ~~**Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

C404.5 Pipe insulation. Piping in circulating hot water systems and heat-trace temperature maintenance systems shall be insulated in accordance with Table C403.2.8. In hot water systems that have a storage tank and that do not have a circulating hot water system, the first 8 feet (2438 mm) of outlet water piping connecting to a storage water heater or a hot water storage tank shall be insulated in accordance with Table C403.2.8. The pipe between the inlet of a storage tank and a heat trap shall be insulated in accordance with Table C403.2.8.

PART II - IPC

[E] 607.5 Pipe insulation. ~~Hot water piping in automatic temperature maintenance systems shall be insulated with 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h • ft2 • °F (1.53 W per 25 mm/m2 • K). The first 8 feet (2438 mm) of hot water piping from a *hot water* source that does not have heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h • ft2 • °F (1.53 W per 25 mm/ m2 • K).~~ Piping in circulating hot water systems and heat-trace temperature maintenance systems shall be insulated in accordance with Table C403.2.8 of the *International Energy Conservation Code*. In hot water systems that have a storage tank and that do not have a circulating hot water system, the first 8 feet (2438 mm) of outlet water piping connecting to a storage water heater or a hot water storage tank shall be insulated in accordance with Table C403.2.8 of the *International Energy Conservation Code*. The pipe between the inlet of a storage tank and a heat trap shall be insulated in accordance with Table C403.2.8 of the *International Energy Conservation Code*. This section shall not apply to the piping in Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Piping in circulating hot water systems and heat-trace temperature maintenance systems in Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane shall be insulated in accordance with R403.4.2 of the *International Energy Conservation Code*.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, references the HVAC piping insulation provisions. The 2012 IECC Commercial Provisions have separate insulation requirements for service water heating piping. It seems logical that the heat loss of the pipe under identical conditions regardless of whether supplying potable water or water for HVAC applications would be the same and should be addressed in the same manner. This situation should be addressed in the IECC to ensure consistency between standard 90.1-2010 and the IECC.

Cost Impact: This code change proposal will increase the cost of construction where pipe insulation > 1 inch wall thickness is required.

CE270-13
PART I – IECC COMMERCIAL PROVISIONS

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

PART II – IPC

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

C404.5-EC-FERGUSON.DOC

CE271-13

C202 (NEW), C404.5, C404.5.1 (NEW), Table C404.5.1 (NEW), C404.5.2 (NEW), C404.5.3 (NEW), IPC [E]607.5

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS TWO SEPARATE CODE CHANGES.

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, gary@aim4sustainability.com

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.5 ~~Pipe~~ Insulation of piping. ~~For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h • ft^2 • °F (1.53 W per 25 mm/m^2 • K). The first 8 feet (2438 mm) of piping in non-hot water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h • ft^2 • °F (1.53 W per 25 mm/m^2 • K).~~ Piping to the inlet of a water heater and piping conveying water heated by a water heater shall be insulated in accordance with Sections C404.5.1, C404.5.2 and C404.5.2.3. Where tubular pipe insulation is used for insulating piping, the thermal conductivity, k, of such insulation shall be not greater than 0.28 Btu per inch/h•ft^2 • F [0.40 W/(m•K)] for water temperatures less than or equal to 140°F (60°C) and not greater than 0.29 Btu per inch/h•ft^2 • F [0.42 W/(m•K)] for water temperatures greater than 140°F (60°C) and less than or equal to 200°F (93.3°C). Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation. This section shall not be construed as requiring insulation on the following:

> ~~**Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h • ft^2 • °F (1.53 W per 25 mm/m^2 • K).~~
>
> 1. The tubing from the connection at the termination of the fixture supply piping to a fixture fitting or a water consuming appliance.
> 2. Valves, pumps, strainers and threaded unions in piping that is 1 inch or less in nominal diameter
> 3. Piping from user-controlled shower and bath mixing valves to the water outlets.
> 4. Cold water piping of a demand recirculation water system.
> 5. Tubing from a hot drinking-water heating unit to the water outlet.
> 6. Piping at locations where a vertical support of the piping is installed.

C404.5.1 Circulating system piping and heat-traced piping. Heated water circulation system piping shall be insulated in accordance with Table C404.5.1. Piping that is heat-traced to maintain heated water temperature shall be insulated in accordance with Table C404.5.1 or shall have insulation thickness in accordance with the heat tracing manufacturer's requirements. Untraced piping within a heat-traced system shall be insulated in accordance with Table C404.5.1.

TABLE C404.5.1

MINIMUM TUBULAR PIPE INSULATION WALL THICKNESS

NOMINAL PIPE OR TUBE DIAMETER (inches)	**MINIMUM INSULATION WALL THICKNESS (inches)**	
	≤140 °F WATER TEMPERATURE	**>140 °F to 200°F WATER TEMPERATURE**
≤3/8	3/8	3/8
> 3/8 to <3/4	1/2	1/2
≥ 3/4 to <1	3/4	1
≥1 to <1 1/2	1	1 1/2
≥1 ½ to <4	1 1/2	2
≥4 to <8	1 1/2	2
≥8	1 1/2	2

For SI: 1 inch = 25.4 mm, °C= [(°F – 32)/1.8]

C404.5.2 Inlet piping connecting to water heaters and storage tanks. Where a water heater or a heated water storage tank is not equipped with integral heat traps, the inlet piping within 8 feet (2438 mm) of piping length of the water heater or storage tank shall be insulated in accordance with Table C404.5.1. This requirement shall not supersede the water heater manufacturer's requirements for a greater insulation thickness on the inlet piping.

Exceptions:

1. Inlet piping or tubing to a water heater serving only *plumbing fixtur*es or *plumbing appliances* that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.

2. Valves, pumps, strainers and threaded unions in water heater or heated water storage inlet piping that is 1 inch (25.4 mm) nominal diameter or less shall not be required to be insulated.

C404.5.3 Other heated water piping. Piping conveying heated water that is not addressed by Sections C404.5.1 and C404.5.2 shall have insulation with a wall thickness of not less than that indicated in Table C404.5.1.

Exceptions:

1. Outlet piping or tubing from a water heater serving only *plumbing fixtur*es or *plumbing appliances* that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.

2. Piping or tubing that is completely surrounded by not less than 1 inch (25.4 mm) thickness of building thermal envelope insulation in walls, attics and crawl spaces shall not be required to be insulated with tubular pipe insulation provided that the piping or tubing is 1 inch (25.4 mm) nominal diameter or smaller.

Add new definition as follows:

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

PART II-IPC

Revise as follows:

[E] 607.5 ~~Pipe~~ Insulation of piping. ~~Hot water piping in automatic temperature maintenance systems shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h • ft^2 • °F (1.53 W per 25 mm/m^2 • K). The first 8 feet (2438 mm) of hot water piping from a hot water-source that does not have heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h • ft^2 • °F (1.53 W per 25 mm/m^2 • K).~~ For other than Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane, piping to the inlet of a water heater and piping conveying water heated by a water heater shall be insulated in accordance with Sections C404.5 through C404.5.3 of the *International Energy Conservation Code*. For Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane, piping to the inlet of a water heater and piping conveying water heated by a water heater shall be insulated in accordance with Section R403.4.2 of the *International Energy Conservation Code*.

Reason: This section has generated a lot of questions over the many years since it was put into the IECC. Some people believe that this section requires all hot water piping to have 1 inch insulation. Others believe that this section only requires that hot water circulating system piping (or heat traced piping) have 1 inch of insulation. Another question that arises is what is meant by "hot water" as there is not a definition of such in the IECC. Other questions that arise are "Is the insulation required to be continuous along the piping?" and "Should really small piping and tubing be insulated?" The exception really isn't an exception but requirements for heat-traced systems.

There is no other place in the Commercial Provisions of the IECC that covers the insulation of Service Water Heating piping. This subject is important! In summary, the language in this section is a mess and the words do not clearly state the intended requirements. Let's stop dancing around this important aspect of lessening energy consumption.

The proposed revisions and why:

C404.5

The intent of the struck-out language can be found in new sections C404.5.1 and C404.5.2. The new language for this struck language is discussed later in this reason statement.

The phrase "water heated by a water heater" was used instead of "hot water" because the IECC does not have a definition for hot water. Code users could refer to the definition found in the IRC and the IPC for hot water which says water of a temperature 110F or greater. But what about tempered water (IPC definition of 85F to 110F)? Keep in mind that ASHRAE 90.1-2007 only requires insulation of service water piping conveying water of 105F of greater. It doesn't seem reasonable to say only "hot water" (as defined by the IPC). If necessary, the committee could request a public comment to amend this section to indicate that the section only covers water 105F and greater.

The statement about protection of personnel from external insulation temperatures and freezing conditions is really common sense but it is added for clarity. It also serves as a reminder for the designer to consider these important issues.

The language "The insulation shall be continuous along the piping." was added to answer the obvious and most often asked question. But keep in mind that this requirement could have serious structural implications when piping is routed through light frame construction members (wood studs and joist, metal studs and solid web joists). The holes to accommodate the piping diameter and insulation could become quite large and in some cases, making piping installation very difficult to perform unless soffits and chases are added and wall thicknesses are increased. Again, the committee could express its opinion on this issue by requesting that a public comment for *not* having insulation be continuous through wood studs and joist/metal studs and solid web joists. Either way, this question needs to be answered in a definitive manner.

The list of items where pipe insulation is not required is almost common sense but still, these items need to be stated to avoid confusion and possible misinterpretations by the code officials. Insulating valves is time consuming and if the right type of valve is not used, insulating is almost impossible (think ball valve without a raised handle). A few uninsulated valves in the system are not going to lose a lot of heat. Pumps are also difficult to insulate and in some cases, insulation might cause overheating of the pump motor. Threaded unions usually only occur in smaller diameter piping systems and are time consuming to insulate. Again, a small amount of heat loss compared to the entire system. Piping or tubing from a small tankless water heater serving one sink is too small to easily insulate. The heat loss is negligible.

C404.5.1

The first sentence of this section is saying exactly what the first struck out sentence in C404.5 says. The second sentence picks up the intent of the requirement in the first sentence of the struck out exception.

C404.5.2

The first sentence picks up the intent of the second sentence of struck-out language in C404.5. If a water heater (or heated water storage tank) does not have integral heat traps, there will be standby heat losses from convection of the heated water into the water inlet and outlet piping of the storage water heater or heated water storage tank. Insulating the inlet and outlet piping for 8 feet mitigates this heat loss. But it is not necessary to include the outlet piping in this section because new Section C404.5.3 requires insulating all other piping (which would include the heater or storage tank outlet piping). If the water (or heated water storage tank) serves a circulating system, then there is no convection of heat water into the piping connected to the heater and storage tank--the water is circulating and Section C404.5.1 takes care of the insulating requirement.

The statement about the water heater manufacturer's insulation thickness requirements is necessary because energy compliance listing for the water heater could require that the inlet and outlet piping be insulated with a thickness greater than ½ inch. And this section should not apply to tankless water heaters as they do not have storage that leads to standby heat losses.

C404.5.3

This section covers the insulation requirements for all other heated water piping that isn't addressed in the two preceding sections. The table of insulation thicknesses mirrors what is required by ASHRAE 90.1-2007 except an entry was added for 3/8 inch pipe or tubing. Some people would like to have the insulation thickness be 1 inch for all piping for "simplicity". But what they fail to realize is that such a requirement would make the installation of smaller piping near or at the ends (outlets) of the system very difficult to accomplish. For example, imagine trying to install ½ inch copper (or PEX) tubing (now 2 5/8 inch diameter with the required insulation) in a 3 ½ inch deep wall cavity with other piping crossing over. Or making that large diameter pass through wood or light frame steel members for a 3 ½ inch deep wall cavity. While ½ inch insulation thickness on ½ inch tubing is still a challenge to install, it is easier. Ideally, many fixtures could be installed using 3/8 inch tubing (only about 1 ¼ inch diameter with the required insulation) inside 3 ½ inch wall cavities. Let's be reasonable and in touch with how buildings are constructed.

Part II – IPC
Section 607.5 did not read exactly the same way as the IECC section (C404.5) that drives this section although the intent was the same. The proposal changes Section 607.5 makes the section read exactly the same way as proposed changes to C404.5. Also, because the IPC covers plumbing for Group R2, R3, R4 occupancies that are 3 stories or less above grade plane, Section 607.5 must have a statement to *exclude* those occupancies because there are different IECC requirements (the Residential provisions of IECC) for those occupancies.

Cost impact: None

CE271-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IPC

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

C404.5-EC-KLEIN

CE272-13
C404.5, IPC [E] 607.5

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE IECC COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS 2 SEPARATE CODE CHANGES.

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.5 Pipe insulation. Insulation in accordance with Table C403.2.8 shall applied to the following:

1. Supply and return piping of a hot water recirculating system connected to a storage water heater or a hot water storage tank.

2. A minimum of eight feet (2438 mm) of outlet piping that begins at a storage water heater or a hot water storage tank that does not serve a hot water recirculating system.

2. Inlet piping between a heat trap and a storage water heater or a hot water storage tank that does not serve a hot water recirculating system.

3. Piping heated by heat trace or impedance methods.

5. Piping where the potential for condensation on the outside of the piping exists and the water temperature in the piping is not less than 40 ºF and not greater than 60ºF.

~~For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K). The first 8 feet (2438 mm) of piping in non-hotwater-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

> ~~**Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

PART II-IPC

Revise as follows:

[E] 607.5 Pipe insulation. This section shall not apply to Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Insulation in accordance with Table C403.2.8 shall applied to the following:

1. Supply and return piping of a hot water recirculating system connected to a storage water heater or a hot water storage tank.

2. A minimum of eight feet (2438 mm) of outlet piping that begins at a storage water heater or a hot water storage tank that does not serve a hot water recirculating system.

2. Inlet piping between a heat trap and a storage water heater or a hot water storage tank that does not serve a hot water recirculating system.

4. Piping heated by heat trace or impedance methods.

5. Piping where the potential for condensation on the outside of the piping exists and the water temperature in the piping is not less than 40 ºF and not greater than 60ºF.

~~Hot water piping in automatic temperature maintenance systems shall be insulated with 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h • ft2 • °F (1.53 W per 25 mm/m2 • K). The first 8 feet (2438 mm) of hot water piping from a *hot water* source that does not have heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h • ft2 • °F (1.53 W per 25 mm/ m2 • K).~~

Reason: This proposed code change incorporates language from the Minnesota Commercial Energy Code that specifies pipe insulation requirements for service water heating equipment and related piping. This standard provides better clarity than the provisions in IECC Section C404.5. This language is necessary because it results in energy efficient piping systems that may otherwise not be required to have pipe insulation due to the ambiguity in this section.

Cost Impact: This code change proposal will not increase the cost of construction.

CE272-13
PART I-IECC-COMMERCIAL PROVISIONS

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

PART II-IPC

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

C404.5-EC-MANZ.DOC

CE273-13

C404.5, R403.4.2 (IRC N1103.4.2), Table R403.4.2 (IRC N1103.4.2), IPC [E] 607.5, IPC [E] 607.5.1 (NEW), IPC [E] 607.5.2 (NEW)

THIS IS A 4 PART CODE CHANGE. PARTS I AND II WILL BE HEARD BY THE IECC COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS 2 SEPARATE CODE CHANGES. PARTS III AND IV WILL BE HEARD BY THE IECC RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Ryan Meres, Institute for Market Transformation, representing self (ryan@imt.org)

PART I — IECC-COMMERCIAL PROVISIONS

Delete and substitute as follows:

~~**C404.5 Pipe insulation.** For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/ m2 × K). The first 8 feet (2438 mm) of piping in non-hotwater-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

> ~~**Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

C404.5 Pipe Insulation. Circulating hot water system piping shall be insulated with not less than 1 inch (25.4 mm) of insulation. Other heated water piping in distribution systems that have a circulating hot water system shall be insulated with not less than 0.5 inch (12.7 mm) of insulation. Heat-trace temperature maintenance system piping shall be insulated in accordance with the heat trace manufacturer's instructions. Other heated water piping in distribution systems that have a heat trace temperature maintenance system shall be insulated with not less than 1 inch (25 mm) of insulation. Other than the insulation in accordance with the heat trace manufacturer instructions, the insulation required by this section shall have a thermal conductivity, *k*, not exceeding 0.27 Btu per inch/h ● ft^2 ● °F (140 W/meter/K).

> **Exceptions:** The following piping shall not be required to be insulated in accordance with this section:
>
> 1. Piping within 1 foot (304.8mm) of the outlet end termination of a fixture supply.
> 2. The portion of piping that passes through a framing member.
> 3. Piping that is surrounded by at least 1 inch (25.4 mm) thickness of building thermal envelope insulation.

PART II-IPC

Delete and substitute as follows:

[E] 607.5 Pipe insulation. ~~Hot water piping in automatic temperature maintenance systems shall be insulated with 1inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K). The first 8 feet (2438 mm) of hot water piping from a *hot water* source that does not have heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~ For other than Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane, insulation of heated water piping shall be in accordance with Section 607.5.1.

[E] 607.5.1 Pipe insulation, other than low rise Group R2, R3 and R4. This section shall apply to other than Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Circulating hot water system piping shall be insulated with not less than 1 inch (25.4 mm) of insulation. Other heated water piping in distribution systems that have a circulating hot water system shall be insulated with not less than 0.5 inch (12.7 mm) of insulation. Heat-trace temperature maintenance system piping shall be insulated in accordance with the heat trace manufacturer's instructions, Other heated water piping in distribution systems that have a heat trace temperature maintenance system shall be insulated with not less than 1 inch (25 mm) of insulation. Other than the insulation in accordance with the heat trace manufacturer, the insulation required by this section shall have a thermal conductivity, *k*, not exceeding 0.27 Btu per inch/h ● ft^2 ● °F (140 W/meter/K).

Exceptions: The following piping shall not be required to be insulated in accordance with this section:

1. Piping within 1 foot (304.8 mm) of the termination of a fixture supply.
2. The portion of piping that passes through a framing member.
3. Piping that is surrounded by at least 1 inch thickness of building thermal envelope insulation.

PART III—IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R403.4.2 (N1103.4.2) ~~Hot~~ Heated water pipe insulation (Prescriptive). Piping conveying heated water from a water heater to the termination of fixture supplies shall be insulated with insulation having a ~~for hot water pipe~~ ~~with a minimum~~ thermal resistance (*R*-value) of not less than R-3. ~~shall be applied to the following:~~

~~1. Piping larger than 3/4 inch nominal diameter.~~
~~2. Piping serving more than one dwelling unit.~~
~~3. Piping from the water heater to kitchen outlets.~~
~~4. Piping located outside the conditioned space.~~
~~5. Piping from the water heater to a distribution manifold.~~
~~6. Piping located under a floor slab.~~
~~7. Buried piping.~~
~~8. Supply and return piping in recirculation systems other than demand recirculation systems.~~
~~9. Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table R403.4.2.~~

~~All remaining piping shall be insulated to at least R-3 or meet the run length requirements of Table R403.4.2.~~

Exceptions: The following piping shall not be required to be insulated in accordance with this section:

1. Piping within 1 foot (304.8 mm) of the termination of a fixture supply.
2. The portion of piping that passes through a framing member.
3. Piping that is surrounded by at least 1 inch thickness of building thermal envelope insulation.

~~TABLE R403.4.2 (IRC N1103.4.2)~~
~~MAXIMUM RUN LENGTH (feet)~~[a]

~~Nominal Pipe Diameter of Largest Diameter Pipe in the Run (inch)~~	~~3/8~~	~~1/2~~	~~3/4~~	~~> 3/4~~
~~Maximum Run Length~~	~~30~~	~~20~~	~~10~~	~~5~~

~~For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.~~
~~a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.~~

PART IV-IPC

Revise as follows:

[E] 607.5 Pipe insulation. In Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane, insulation of heated water piping shall be in accordance with Section 607.5.1. For all other occupancies, hot water piping in automatic temperature maintenance systems shall be insulated with 1inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K). The first 8 feet (2438 mm) of hot water piping from a *hot water* source that does not have heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).

[E] 607.5.1 Pipe insulation, low rise Groups R2, R3 and R4. This section shall apply to Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Piping conveying heated water from a water heater to the termination of fixture supplies shall be insulated with insulation having a thermal resistance (*R*-value) of not less than R-3.

Exceptions: The following piping shall not be required to be insulated in accordance with this section:

1. Piping within 1 foot (304.8 mm) of the termination of a fixture supply.
2. The portion of piping that passes through a framing member.
3. Piping that is surrounded by at least 1 inch thickness of building thermal envelope insulation.

Parts I & II Reason: The provisions in the IPC, which are based on section C404.5 in the IECC are not the same. As a consequence, the requirement to insulate the first 8 feet of piping became unclear when the 2012 IPC added recirculation systems and heat trace as sources of hot water (in addition to *Water Heaters*). To avoid confusion and misinterpretation, the IPC and IECC should be correlated on pipe insulation.

The intent of this proposal is to make the provisions in the IPC identical to those in the IECC, and require pipe insulation on all heated water piping. The provisions are now more clear, easier to inspect and enforce.

Parts III & IV Reason: The 2012 edition of the IECC added Section R403.4.2 on hot water pipe insulation, containing a list of 9 factors or locations that require pipe to be insulated to R-3. After the list of 9 locations, the section goes on to say “All remaining piping shall be insulated to at least R-3 or meet the run length requirements…” This section as it is printed in the 2012 IECC essentially requires that all hot water piping be insulated to R-3 unless a given diameter of piping meets the maximum run length requirements of the table. The current section provides far more language and complexity than is necessary, making compliance and enforcement difficult.

The proposed code change simplifies the language making it easier for compliance by plumbing trades and enforcement by code officials; while still retaining the intent of the 2012 language.

The same provisions need to be correlated with Section 607.5 in the IPC. Section 607.5 of the IPC currently correlates with only the commercial provisions of the IECC. The new Section 607.5.1 is identical to the requirements of what is proposed for Section R403.4.2 making the language of the IPC section appropriate for Group R2, R3 and R4 occupancies. For example, under the 2012 codes, a 3 story apartment complex would fall under the residential provisions of the IECC, and also governed by the IPC, and the heated water piping requirements of the two codes are in conflict. If all parts of this proposal is approved, the conflict will be eliminated. (Note that if Parts II & IV of this proposal is approved, the section IPC section number for Part IV will automatically be renumbered to 607.5.2).

Given the 2012 code provisions, we estimate that this change will result in an increase cost of construction of about 20 percent or $27-$65. This direct cost is offset by the reduced cost of trying to figure out what piping needed to be insulated and to the extra cost of inspection due to a complicated code provision.

[1] Klein, Gary, “Cost Estimation for Materials and Installation of Hot Water Piping Insulation,” prepared for Pacific Northwest National Laboratory, June 2012, accessible at <http://bc3.pnnl.gov/wiki/index.php/Downloads>.

Reason: The provisions in the IPC, which are based on this section in the IECC are not the same. As a consequence, the requirement to insulate the first 8 feet of piping became unclear when the 2012 IPC added recirculation systems and heat trace as sources of hot water (in addition to *Water Heaters*). To avoid confusion and misinterpretation, the IPC and IECC should be correlated on pipe insulation.

The intent of this proposal is to make the provisions in the IPC identical to those in the IECC, and require pipe insulation on all heated water piping. The provisions are now more clear, easier to inspect and enforce.

Cost Impact: This code change proposal will increase the cost of construction only for builders that may have used the “maximum run length” exception and only for hot water piping that was subject to that exception. A recent estimate[1] of the cost of insulating hot water piping with R-3 foam insulation is $1.10 to $1.50 per linear foot, including labor, materials, and profit for the plumbing subcontractor. The cost of insulating all hot water piping in a 2400 ft^2 home was estimated by the same study to be $135 to $325, depending on building configuration. It should be noted that these estimates are based on insulation of *all* hot water piping in the home.

CE273-13
PART I-IECC-COMMERCIAL PROVISIONS

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

PART II-IPC

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

PART III-IECC-RESIDENTIAL PROVISIONS

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

PART IV-IPC

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

C404.5 (NEW)-EC-MERES.DOC

CE274-13

C202 (NEW), C404.5 (NEW), C404.5.1 (NEW), C404.5.1 (NEW), Table C404.5.1 (NEW), C404.5.2 (NEW), C404.5.2.1 (NEW)

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, gary@aim4sustainability.com

Add new text as follows:

C404.5 Efficient heated water supply piping. Heated water supply piping shall be in accordance with Section C404.5.1 or Section C404.5.2. The flow rate through ¼ inch piping shall not exceed 0.5 gpm (1.9 Lpm). The flow rate through 5/16 inch piping shall not exceed 1 gpm (3.8 Lpm). The flow rate through 3/8 inch piping shall not exceed 1.5 gpm (5.7 Lpm).

C404.5.1 Maximum allowable pipe length method. The maximum allowable piping length from the nearest source of heated water to the termination of the fixture supply pipe for *plumbing fixtures* and *plumbing appliances* shall be in accordance with the maximum piping length column in Table C404.5.1. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

TABLE C404.5.1
PIPING VOLUME AND MAXIMUM PIPING LENGTHS

NOMINAL PIPE SIZE (inch)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)	
		WATER FROM A WATER HEATER	WATER FROM A RECIRCULATION LOOP OR HEAT TRACED PIPE
1/4	0.33	50	50
5/16	0.5	50	48
3/8	0.75	50	32
1/2	1.5	43	16
5/8	2	32	12
3/4	3	21	8
7/8	4	16	6
1	5	13	5
1 ¼	8	8	3
1 ½	11	6	2
2 or larger	18	4	1

1 Gallon = 128 ounces. For SI: 1 inch=25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L

C404.5.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section C404.5.2.1. The maximum volume from the nearest source of heated water to the termination of the fixture supply pipe for a *plumbing fixture* or *plumbing appliance* shall be 0.5 gallon (1.89 L) where the source of heated water is a water heater; and 0.19 gallon (0.7 L) where the source of heated water is a recirculating system or heat-traced piping.

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the volume column in Table C404.5.1. The volume contained within fixture shut off valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

Reason: This change speeds hot water to the user, saves energy and water, and potentially lowers construction costs. All these are accomplished by limiting the volume of water in the pipes.

We have all have turned on the hot water and waited for it to get hot. While we wait water runs down the drain, wasting clean water. While we wait, our time is wasted. When we are done there is still hot water in the pipes, water which cools thereby wasting as much energy as it took to heat the water in the pipes. Pipes with larger volumes take longer to fill, waste more and are potentially more expensive to build.

This proposal remedies the problems above by reducing the water volume between the source of heated water and the use. The first method (Section R403.4.2.1) requires no calculation; it limits the water volume in the pipes by limiting the pipe length. The second option (Section R403.4.2.1) requires a calculation of volume in the pipes, but provides a table that translates the pipe length into a volume (columns 1 and 2); and provides quick options for different pipe assumptions in columns 3 and 4.

In simple form, cutting the volume in half: cuts the wait time in half, cuts the clean water wasted down the drain in half, cuts the energy loss while water goes through the pipes in half, and cuts the loss of energy from hot water left in the pipes after use in half.

Why is the maximum volumes 0.5 gallon when the source of heated water is a water heater? So that following standard practice for plumbing engineers and meeting the minimum requirements in the energy code will be aligned. At present, they are not, with the result that hot water delivery times are greater than 30 seconds after the tap is opened; unacceptable performance according to the American Society of Plumbing Engineers.

The American Society of Plumbing Engineers (ASPE) provides plumbing engineers with the guidance for hot water distribution system design as shown in Figure 1. I believe that the minimum energy code should have at least marginal performance at typical actual flow rates. These actual flow rates generally range from 1-2 gpm for private lavatory faucets, showerheads, dishwashers and washing machines. This is true even though faucets are allowed to be 2.2 gpm @ 60 psi and showerheads 2.5 gpm @80 psi. The reason for actual flow rates being lower than rated flow rates is due to the fact that the pressure in the building is often less than the rated pressure. With fixed orifice aerators, common in minimally legal faucets and showerheads, the flow rate drops off rather rapidly as the pressure decreases.

It makes sense to me that the minimum code should provide for at least marginal performance in buildings that are supplied with low pressure. This means that we need to be sure that the time-to-tap is still reasonable even when flow rates are at the lower end of the typical range; that is close to 1 gpm. According to ASPE, marginal performance would mean that hot water needs to arrive in no longer than 30 seconds after the tap is opened. Figure 2 shows that this will be true when the volume of water between the source and the use does not exceed 0.5 gallon.

Figure 1 ASPE Time-to-Tap Performance Criteria

	Acceptable Performance	1 – 10 seconds
	Marginal Performance	11 – 30 seconds
	Unacceptable Performance	31+ seconds

Source: Domestic Water Heating Design Manual – 2nd Edition, ASPE, 2003, page 234

Figure 2 Converting Flow Rate and Pipe Volume to Time-to-Tap

Volume in the Pipe		**Minimum Time-to-Tap (seconds) at Selected Flow Rates**					
Gallons	**Ounces**	**0.25 gpm**	**0.5 gpm**	**1 gpm**	**1.5 gpm**	**2 gpm**	**2.5 gpm**
0.02	**2**	4	1.9	0.9	0.6	0.5	0.4
0.03	**4**	8	4	1.9	1.3	0.9	0.8
0.06	**8**	15	8	4	2.5	1.9	1.5
0.13	**16**	30	15	8	5	4	3
0.19	**24**	45	23	11	8	6	5
0.25	**32**	60	30	15	10	8	6
0.50	**64**	120	60	30	20	15	12
1.00	**128**	240	120	60	40	30	24

Why is the maximum volume 0.19 gallon when the source of heated water is a circulation loop or heat-traced pipe? In exchange for the flexibility in the location of the water heater relative to the plumbing fixtures and plumbing appliances, the allowable volume that will be wasted has been reduced and the time-to-tap improved so that it will almost always fall into ASPE's range for Acceptable Performance.

The definition proposed is used in both the IPC and the IRC.

For more information and background on issues related to hot water distribution and for a more detailed analysis in support of this proposal please go to http://www.aim4sustainability.com Follow the link on the home page to Codes.

Cost impact: There are several ways to meet the requirements of this proposal, many of which cost less than current piping practices. I would recommend that builders and developers select one of the less expensive methods.

CE274-13

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

C404.5 #2 (NEW)-EC-KLEIN

CE275-13

C202 (NEW), C404.5 (NEW), C404.5.1 (NEW), Table C404.5.1 (NEW), C404.5.2 (NEW), C404.5.2.1 (NEW)

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

Add new text as follows:

C404.5 Efficient heated water supply piping. Heated water supply piping shall be in accordance with Section C404.5.1 or Section C404.5.2. The flow rate through ¼ inch piping shall not exceed 0.5 gpm (1.9 Lpm). The flow rate through 5/16 inch piping shall not exceed 1 gpm (3.8 Lpm). The flow rate through 3/8 inch piping shall not exceed 1.5 gpm (5.7 Lpm).

C404.5.1 Maximum allowable pipe length method. The maximum piping length from the nearest source of heated water to the termination of the fixture supply pipe for a public lavatory faucet shall be in accordance with the maximum piping length column in Table C404.5.1. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

TABLE C404.5.1
PIPING VOLUME AND MAXIMUM PIPING LENGTHS

NOMINAL PIPE SIZE (inch)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)
		LAVATORY FAUCETS—PUBLIC
1/4	0.33	6
5/16	0.5	4
3/8	0.75	3
1/2	1.5	2
5/8	2	1
3/4	3	0.5
7/8	4	0.5
1	5	0.5
1 ¼	8	0.5
1 ½	11	0.5
2 or larger	18	0.5

For SI: 1 inch=25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L

C404.5.2 Maximum allowable pipe volume method. The maximum piping volume from the nearest source of heated water to the termination of the fixture supply pipe for a public lavatory faucet shall be 2 ounces (0.06 L). The water volume in the piping shall be calculated in accordance with Section C404.5.2.1.

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the volume column in Table C404.5.1. The volume contained within fixture shut off valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

Reason: The problem of heated water taking an excessively long time to arrive at lavatory faucets in public restrooms is well known. The length of time the faucets are used during each hand washing event is very short, often around 5 seconds. Federal law requires low flow rate or small, metered volumes for the faucets in these applications. Health codes expect heated water for washing hands in these applications. The dilemma is that the volume of not-hot water in the piping from the source of hot water to the faucets is much too large for the heated water to arrive in a timely fashion; even at the 50-foot limit currently required in the 2012 IPC.

Supporting this proposal will correlate the IECC with Federal law and local health codes by providing heated water for hand washing in a timely matter.

The delivery of hot water to public lavatory faucets needs to be considered separately because of potential health issues. The events are short and the flow rates are low. Table 1 shows the time-to-tap performance based on the requirements in the proposal. The 0.25 and 0.5 gpm columns are typical of the flow rates for public lavatory faucets. The volume in the pipe was chosen so that heated water would arrive in the first part of the hot water event so that every person who uses the public lavatory will have the benefits of hot water.

Table 1 Time-to-Tap Performance when the Volume in the Piping from the Source to the Use is 2 ounces

Volume in the Pipe (ounces)	~~Minimum~~ Time-to-Tap (seconds) at Selected Flow Rates					
	0.25 gpm	**0.5 gpm**	**1 gpm**	**1.5 gpm**	**2 gpm**	**2.5 gpm**
2	3.8	1.9	0.9	0.6	0.5	0.4

The energy savings comes from not losing the heat from the water as it tries to arrive at the faucets.
For more information and background on issues related to hot water distribution please read the 4-part series at:
http://www.allianceforwaterefficiency.org/Residential_Hot_Water_Distribution_System_Introduction.aspx

Cost impact: There are several ways to meet the requirements of this proposal, some of which cost less than current heated water system practices. I would recommend that builders and developers select one of the less expensive methods.

CE275-13

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

C404.5 #3 (NEW)-EC-KLEIN

CE276-13
C404.5 (NEW), Table C404.5 (NEW)

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

Add new text as follows:

C404.5 Fixture supply piping size for conveying heated water. The fixture supply piping conveying heated water to fixture fittings or appliances shall be sized in accordance with Table C404.5. The maximum length of such fixture supply piping shall be 50 feet (1270 mm). The heated water fixture supply piping and the cold water fixture supply piping to a plumbing fixture or a plumbing appliance shall be the same nominal size. The fixture supply piping sizes of this section shall supercede the minimum fixture supply pipe sizing in Section 604.5 of the *International Plumbing Code*.

TABLE C404.5
FIXTURE SUPPLY PIPING SIZE
FOR CONVEYING HEATED WATER

FLOW RATE (gpm)	NOMINAL PIPING OR TUBING SIZE (inches)
≤ 0.5	1/4
>0.5 to ≤1.0	5/16
>1.0 to ≤1.5	3/8

For SI: 1 gallon per minute = 3.875 L/m, 1 inch = 25.4 mm

Reason: The purpose of this code change is to ensure that the minimum diameter of the tubing on a fixture supply is safely (pressure drop and velocity) matched to the flow rate of the fixture to which it is connected.

Enabling smaller diameter tubing is important to energy efficiency because it reduces the volume in the fixture supply, which reduces the temperature drop during the use periods and the energy that is lost when the water in the piping cools down. It also has the benefit of reducing the time it takes for hot water to arrive.

As plumbing fixture and appliance flow rates get lower, as long as the maximum flow rate is selected properly, the physics clearly indicates that there will be no pressure loss or velocity problems if smaller diameter tubing is allowed. Calculations were performed using the same formula used by plumbing engineers to design hot water distribution systems to determine the combinations of flow rates and diameters shown in the table. In order to ensure that a piping system will work properly for heated water with a limit of 50 feet of developed length, the maximum developed length was capped at 50 feet for the analysis done to support this code change. The pressure drop was limited to 5 psi and the velocity was limited to 4 feet per second. PEX, CPVC and copper Types K, L, and M were evaluated. In order to make it simple to inspect, the maximum flow rate for each nominal diameter was chosen so that the worst performing material still met the criteria.

Cost impact: The code change proposal will not increase the cost of construction.

CE276-13

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

C404.5 #1 (NEW)-EC-KLEIN

CE277-13
C404.5.1 (NEW)

Proponent: Howard Ahern representing Airex Mfg. (howard.ahern@airexmfg.com)

Add new text as follows:

C404.5.1 Water heater piping insulation protection. Exposed water piping that is insulated and that is connected to a water heater shall have the insulation protected from damage by a removable and reusable covering. The covering shall extend for not less than 5 feet (1524 mm) from the water heater. The covering shall not be adhesive tape.

Reason. This code change is needed to insure integrity of the water heater piping insulation. Pipe insulation is often silt open to install over water heating piping, the slits often stay open or adhesive used to glue slit close degrade and slits open wasting energy and money. Removable and reusable covering will insure pipe insulation slits are closed to save energy. This change will ensures steady, long-term thermal performance and maintain system integrity, sustainability, of the insulation saving energy.

Water Heating equipment require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, maintenance provides an excuse for the piping insulation to be touched and or removed. Pipe insulation removal often results in damage to the insulation itself requiring replacement.

Protection for piping insulation therefore needs to be removable and reusable. This will help insure system integrity and sustainability of the pipe insulation, reducing replacement.

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

CE277-13

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

C404.5.1 (NEW)-EC-AHERN.DOC

CE278-13
C404.6, C404.7 (NEW), IPC [E] 607.2.1, IPC [E] 607.2.1.1 (NEW)

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.6 Hot water temperature maintenance system controls. For hot water distribution system circulating ~~hot water~~ ~~system~~ pumps ~~or~~ and heat trace, the pumps and heat trace shall be arranged to be turned off ~~either~~ automatically ~~or manually~~ when there is ~~limited~~ not hot water demand. Operating controls shall be *readily accessible* .

C404.7.1 Storage tank hot water circulation systems. Circulating pumps intended to maintain storage tank water temperature shall have controls that will limit operation of the pump from heating cycle start up to not greater than 5 minutes after the end of the cycle. *Ready access* shall be provided to the operating controls.

PART II–IPC

Revise as follows:

[E] 607.2.1 Hot water temperature maintenance system controls. ~~Automatic~~ For hot water distribution system circulating ~~hot water~~ ~~system~~ pumps ~~or~~ and heat trace, the pumps and heat trace shall be arranged to be ~~conveniently~~ turned off ~~either~~ automatically ~~or manually~~ when there ~~hot water system~~ ~~is not in operation~~. is ~~limited~~ not hot water demand. *Ready access* shall be provided to the operating controls. This section and Section 607.2.1.1 shall not apply to hot water temperature maintenance system controls in Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Hot water temperature maintenance system controls in Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane shall be in accordance with Section R403.4.1 of the *International Energy Conservation Code.*

> **[E] 607.2.1.1 Storage tank hot water circulation systems.** Circulating pumps intended to maintain storage tank water temperature shall have controls that will limit operation of the pump from heating cycle start up to not greater than 5 minutes after the end of the cycle. *Ready access* shall be provided to the operating controls.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the criteria of the IECC Commercial Provisions, has a provision to circulating system pump controls. This situation is not addressed in the IECC and needs to be to ensure consistency between standard 90.1-2010 and the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE278-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IPC

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

C404.6-EC-FERGUSON.DOC

CE279-13

C404.6, C404.6.1 (NEW), C404.6.2 (NEW), Chapter 5, IPC [E]607.2.1, IPC [E]607.2.1.1 (NEW), IPC [E]607.2.1.1.1 (NEW), IPC [E]607.2.1.1.2 (NEW), IPC Chapter 14

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND TWO WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I-IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.6 ~~Circulating~~ ~~hot~~ Heated water circulating and temperature maintenance systems ~~controls~~ (Mandatory). ~~Circulating hot water systems shall be provided with an automatic or readily *accessible* manual switch that can turn off the hot-water circulating pump when the system is not in~~ use Heated water circulation systems shall be in accordance with Section C404.6.1. Heat trace temperature maintenance systems shall be in accordance with Section C404.6.2. Automatic controls, temperature sensors and pumps shall be *accessible*. Manual controls shall be *readily accessible*.

C404.6.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Circulation system pump controls shall be demand activated. The controls shall start the pump upon sensing the presence of a user of a fixture or appliance, receiving a signal from the action of an action of a user of a fixture or appliance or sensing the flow of heated water to a fixture or appliance. The controls shall limit the water temperature increase in the return water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the return piping and shall limit the return water temperature to 102ºF (38.9ºC).

C404.6.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1. Controls for such systems shall be able to automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

Add new standard to Chapter 5 as follows:

IEEE The Institute of Electrical and Electronic Engineers, Inc.
3 Park Avenue
New York, NY 1016-5997

515.1-2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications

PART II-IPC

Revise as follows:

[E] 607.2.1 ~~Hot~~ Heated water circulation and temperature maintenance systems ~~controls~~. For Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane, ~~automatic~~ circulating hot water systems ~~pumps or heat trace~~ shall be ~~arranged to be~~ provided with a ~~conveniently turned off, automatically or~~ manual~~ly~~ switch having ready access or an automatic switch~~,~~ that can turn off

~~when~~ the hot water circulating pump when the system is not in use ~~operation~~. Heated water circulation and temperature maintenance systems for other than Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane shall be in accordance with Section 607.2.1.1.

[E] 607.2.1.1 For other than Group R2, R3 and R4 occupancies 3 stories or less. This section shall apply to other than Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade plane. Heated water circulation systems shall be in accordance with Section 607.2.1.1.1. Heat trace temperature maintenance systems shall be in accordance with Section 607.2.1.1.2. *Access* to automatic controls, temperature sensors and pumps shall be provided. *Ready access* to manual controls shall be provided.

[E] 607.2.1.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Circulation system pump controls shall be demand activated. The controls shall start the pump upon sensing the presence of a user of a fixture or appliance, receiving a signal from the action of an action of a user of a fixture or appliance or sensing the flow of heated water to a fixture or appliance. The controls shall limit the water temperature increase in the return water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the return piping and shall limit the return water temperature to 102ºF (38.9ºC).

[E] 607.2.1.1.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1. Controls for such systems shall be able to automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

Add new standard to Chapter 14 as follows:

The Institute of Electrical and Electronic Engineers, Inc.
3 Park Avenue
New York, NY 1016-5997

IEEE

515.1-2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications

Reason: There are 2 primary reasons for this proposed change. 1) Correlate the language in the IECC and the IPC; 2) Clarify the requirements for heated water circulation systems and for heat trace systems, if they are installed. The proposed changes do not require the use of circulation or heat trace.

The current code language is not the same in the IECC and the IPC. It should be.

The current language allows for continuously operating circulation pumps, which creates inefficiency in the hot water distribution system. It also does not address the use of heat trace in both codes and there is currently no requirement that the heat trace be suitable for the application. The consequence is that water heating energy consumption is increased.

Figure 1 shows that demand activated circulation is significantly more energy efficient than any other type of heated water circulation system. The annual energy needed to keep the loop hot with water heated electrically or with natural gas are shown separately from the energy needed for the pump. The majority of the energy is lost in keeping the water in the loop at the desired temperature (all of it if there is a gravity loop). A small loop, 100 feet including the supply and the return was analyzed. The savings ranges from 87.5 percent when compared to a recirculation system that runs only 2-hours per day to 99 percent when compared to a recirculation system that runs only 24-hours per day. The operating costs and savings remain proportional as the length of the circulation loop and the flow rate of the pump increase.

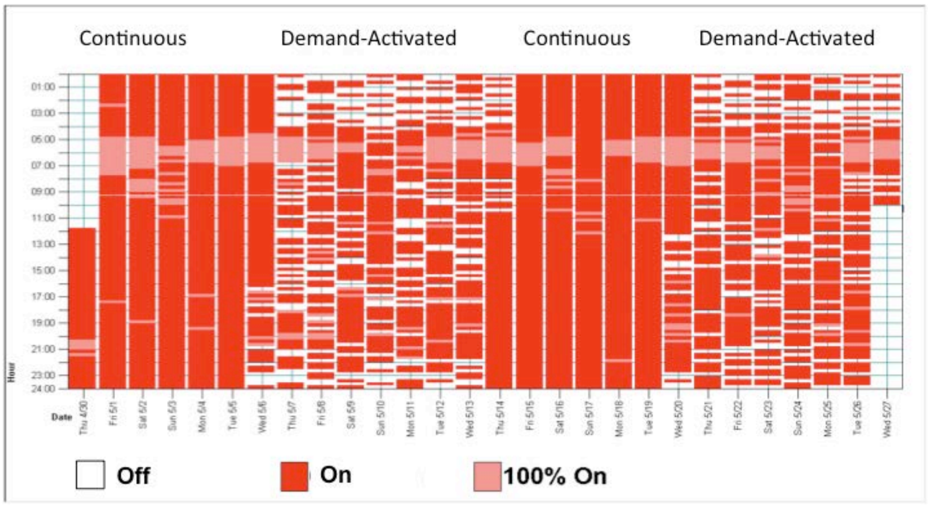
Figure 1 Annual Energy Requirements for Demand Activated Circulation and Standard Recirculation

	Standard Recirculation						**Demand Activated Circulation**
	Daily Hours of Operation						
	24	12	8	6	4	2	0.25
Loop Heat Losses							

Natural Gas (therms)	292	146	97	73	49	24	3
Electric (kWh)	6,388	3,194	2,129	1,597	1,065	532	67
Pump Energy (kWh)	438	219	146	110	73	37	8

Figure 2 shows the differences in run-time at the water heater (or boiler) between a continuously pumped recirculation loop and one that has a demand activated pump control. Blank space (white) means the water heater was off. Red means some percent of run-time between zero and continuous. Pink means the water heater or boiler was running continuously. The test results come from studies done by Southern California Gas Company on a sample of more than 300 multi-family buildings with central water heaters and recirculation systems. Most systems tested were built before insulation was required on hot water recirculation loops. Savings ranged from 10-30 percent of the water heating energy use and 84 percent of the pump electricity use. The costs for installing the retrofit were paid back in just about one year. In new construction, the marginal costs would be recovered in just a few months

Figure 2 Run-time of Water Heater with Two Different Pump Controls



Why is demand-activated circulation such an efficient strategy? The 2012 IECC, IPC and IRC require that the hot water piping in automatic temperature maintenance systems in new buildings be insulated with pipe insulation. This means the water in the circulation loop will stay hot for a very long time – up to 45 minutes for ¾ inch nominal pipe up to 2 hours for 2-inch nominal pipe – even if the circulating pump is shut off. If this is the case, why run the pump when the water is still hot? Why run the pump when no one is in the building or when no one is demanding hot water? The only time it makes sense to run the pump is shortly before hot water is needed: hence the requirement that the pump be controlled on-demand.

The requirements for heat trace are partly to ensure that the systems can be operated in the most energy efficient manner consistent with providing heated water to the occupancy. The reference standards are included to ensure that installed systems are safe for the intended application. The energy consequences of using heat trace are very reasonable. Figure 3 presents the energy requirements for a heat trace system with the same hot water supply piping as the circulation systems shown in Figure 1. The energy requirements of keeping the trunk line hot – the same as keeping the supply portion of the loop hot in a circulating system – are 701 kWh per year, assuming 12 hours at high temp (115F) and 12 hours at economy temp (105F). This is equivalent to operating the loop about 3 hours per day, but with hot water available 24/7 in the supply trunk! This is a significant savings when water heating is done electrically or with a similarly expensive fuel. If the branches are also traced, we can deliver heated water even more quickly to the fixtures using only 1,682 kWh per year, which is the same energy as running the loop a little more than 6 hours a day.

Figure 3. Annual Energy Needed for Electric Heat Trace Systems

Heat Trace			
	(kWh per year)		
	Trunk	**Br**	**T-Br**
Supply Heat Losses			
High Temp	394	552	946
Economy Temp	307	429	736
Total Electricity	701	981	1,682

Cost impact: The proposal does not require either circulation or heat trace; however if either is selected, it clarifies the requirements for installation. Most recirculation systems today are installed with some form of control, usually a timer, a bandwidth thermostat (aquastat) or both. Some come with more sophisticated controls, such as programmable or are connected to an energy management system. In some cases, switching from these control strategies to demand activated controls will cost less. In other cases, the demand-activated controls will cost more.

Analysis: A review of the standards proposed for inclusion in the code, CSA 22.2 No. 130 and UL 515 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1 2013.

CE279-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II-IPC

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

C404.6-EC-KLEIN

CE280-13

C404.6, C404.6.1 (NEW), C404.6.2 (NEW), IPC [E] 607.2.1, IPC [E] 607.2.1.1, IPC [E] 607.2.1.2, R403.4.1 (IRC N1103.4.1), R403.4.1.1 (NEW) (IRC N1103.4.1.1 NEW), R403.4.1.2 (NEW) (IRC N1103.4.1.2 NEW)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY THE IECC-COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AS 2 SEPARATE CODE CHANGES. PART III WILL BE HEARD BY THE IECC-RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Greg Towsley, Grundfos, representing self (gtowsley@grundfos.com)

PART I - IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.6 ~~Hot~~ Heated water system controls. Circulating hot water system pumps or heat trace water temperature maintenance systems shall be controlled in accordance with Sections C404.6.1 and C406.6.2. ~~arranged to be turned off either automatically or manually when there is limited hot water demand. Ready access shall be provided to the operating controls.~~ Automatic controls, temperature sensors, and pumps shall be *accessible*. Manual controls shall be *readily accessible*. Heated water circulation systems without controls such as gravity and thermo-syphon circulation systems, shall be prohibited. Continuous operation of pumps in heated water circulation systems shall be prohibited.

C404.6.1 Circulation pumps. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for heated water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

C404.6.2 Heat trace. Heat trace controls shall automatically adjust the energy input to the piping to maintain the desired water temperature in the piping system. The controls shall adjust the energy input to the heat tracing when the controls identify demand for heated water.

PART II - IPC

Revise as follows:

[E] 607.2.1 Hot water system controls. ~~Automatic~~ Circulating hot water system pumps ~~or~~ and heat trace water temperature maintenance systems shall be controlled in accordance with Sections 607.2.1.1 and 607.2.1.2. ~~arranged to be turned off automatically or manually when there is limited hot water demand. Ready access shall be provided to the operating controls.~~ *Access* shall be provided to automatic controls, temperature sensors, and pumps. *Ready access* shall be provided to manual controls. Hot water circulation systems without controls such as gravity and thermo-syphon circulation systems, shall be prohibited. Continuous operation of pumps in hot water circulation systems shall be prohibited.

[E] 607.2.1.1 Circulation pumps. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for heated water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

[E] 607.2.1.2 Heat trace. Heat trace controls shall automatically adjust the energy input to the piping to maintain the desired water temperature in the piping system. The controls shall adjust the energy input to the heat tracing when the controls identify demand for heated water.

PART III – IECC – RESIDENTIAL PROVISIONS

Revise as follows:

R403.4.1 (N1103.4.1) Circulating hot water systems (Mandatory). Circulating hot water systems and heat trace water temperature maintenance systems shall be controlled in accordance with Sections R403.4.1.1 and R403.4.1.2. ~~provided with an automatic or readily *accessible* manual switch that can turn off the hot-water circulating pump when the system is not in use.~~ Automatic controls, temperature sensors, and pumps shall be *accessible*. Manual controls shall be *readily accessible*. Hot water circulation systems without controls such as gravity and thermo-syphon circulation systems, shall be prohibited. Continuous operation of pumps in hot water circulation systems shall be prohibited.

R403.4.1.1 (N1103.4.1.1) Circulation pumps. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

R403.4.1.2 (N1103.4.1.2) Heat trace. Heat trace controls shall automatically adjust the energy input to the piping to maintain the desired water temperature in the piping system. The controls shall adjust the energy input to the heat tracing when the controls identify demand for heated water.

Reason: The current code text allows for the use of continuously operating circulation pumps in a hot water system. With no limitation of prohibiting pumps that operate continuously, this control methodology is not energy efficient, even when there is no need for hot water or there is ample hot water available in the system.

Energy can be saved with circulating hot water systems by operating the pump only when there is a demand for hot water. In addition, the pump does not need to operate when the hot water system is capable of providing the hot water at the desired temperature.

Cost Impact: The code change proposal will not increase the cost of construction.

CE280-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IPC

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

PART III– IECC-RESIDENTIAL PROVISIONS

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

C404.6-EC-TOWSLEY.DOC

CE281-13
IPC [E]607.2.1, IPC [E]607.2.1.1 (New), IPC [E]607.2.1.2 (New)

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, gary@aim4sustainability.com

Revise as follows:

[E] 607.2.1 ~~Hot water system~~ Controls for circulating systems and heat trace. The controls for ~~automatic~~ heated water circulating ~~hot water~~ system pumps ~~or~~ and heat trace for maintaining heated water temperature shall be in accordance with Sections 607.2.1.1 and 607.2.1.2. ~~arranged to be conveniently turned off, automatically or manually, when the hot water system is not in operation.~~

[E] 607.2.1.1 Controls in R2, R3 and R4 occupancies. In Group R2, R3 and R4 occupancies that are 3 stories or less in height above grade, the controls for hot water circulating system pumps shall be provided with an automatic or manual switch that can turn off the hot water circulating pump when the system is not in use. *Ready access* shall be provided to manual switches.

[E] 607.2.1.2 Controls in all other occupancies. In occupancies not covered by Section 607.2.1.1, circulating hot water pumps or heat trace shall be arranged to be turned off either automatically or manually when there is limited hot water demand. *Ready access* shall be provided to the operating controls.

Reason: The proposal is strictly logistical – no new requirements are being added. The IECC has slightly different language for residential and commercial requirements for controls for heated water circulation system pumps and heat tracing. The current section in the IPC only reflects the IECC requirements for commercial buildings. But remember, the IPC covers buildings that the IECC considers to be residential buildings. The different needs for residential buildings needs to be called out in the IPC. These requirements, IPC 607.2.1.1 and IPC 607.2.1.2, are coming from IECC Sections C404.6 and R403.4.1, respectively. The IPC needs to be revised to handle the requirements separately. Although the current language of the two sections is similar, it is anticipated that other code change proposals in this cycle and in future cycles will cause significant difference between the commercial and residential provisions for this subject in the IECC. The IPC needs to be aligned to handle this event. Another intent of this code change is to indicate that the technical requirements of Sections 607.2.1.1 and 607.2.1.2 be identical to those in the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

CE281-13

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

IPC [E]607.2.1-EC-KLEIN

CE282-13
C404.7 (NEW), IPC Chapter 2, IPC [E]607.2.1.1 (NEW)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND TWO WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C404.7 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a *demand recirculation water system.* Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits the temperature entering the cold water piping to 102ºF (38.9 ºC).

PART II-IPC

Add new text as follows:

[E] 607.2.1.1 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a *demand recirculation water system.* Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits the temperature entering the cold water piping to 102ºF (38.9 ºC).

Add definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where one more pumps prime the service hot water piping with heated water upon demand for hot water.

Reason: The purpose of this code change proposal is to clarify the requirements for installing circulation pumps in applications that use a cold water supply pipe to circulate the water back to the water heater. Demand recirculation water systems are significantly more energy efficient than other recirculation systems and are inherently safer when the cold water supply is used as the return.

Figure 1 shows that demand activated circulation is significantly more energy efficient than any other type of heated water circulation system. The annual energy needed to keep the loop hot with water heated electrically or with natural gas are shown separately from the energy needed for the pump. The majority of the energy is lost in keeping the water in the loop at the desired temperature (all of it if there is a gravity loop). A small loop, 100 feet including the supply and the return was analyzed. The savings ranges from 87.5 percent when compared to a recirculation system that runs only 2-hours per day to 99 percent when compared to a recirculation system that runs only 24-hours per day. The operating costs and savings remain proportional as the length of the circulation loop and the flow rate of the pump increase.

Figure 1 Annual Energy Requirements for Demand Activated Circulation and Standard Recirculation

	Standard Recirculation						Demand Activated Circulation
	Daily Hours of Operation						
	24	12	8	6	4	2	0.25
Loop Heat Losses							
Natural Gas (therms)	292	146	97	73	49	24	3
Electric (kWh)	6,388	3,194	2,129	1,597	1,065	532	67
Pump Energy (kWh)	438	219	146	110	73	37	8

The inherently better safety comes from the fact that the controls specified for demand recirculation water systems limit the flow of water from the hot water supply into the cold water supply to only minutes a day and because they limit the temperature of the water that is allowed to go into the cold water supply. There are five other control strategies for heated water recirculation systems (thermosyphon (gravity), continuous pumping, timer controlled, bandwidth temperature sensor (aquastat) controlled and a combination of timer and bandwidth temperature sensor (aquastat) controlled and none of them has the ability to meet these stringent requirements.

The requirements of this section should be identical in both the IECC and the IPC, since the language for the controls does not depend on occupancy

For more information and background on issues related to hot water distribution and for a more detailed analysis in support of this proposal please go to http://www.aim4sustainability.com Follow the link on the home page to Codes.

Cost impact: This proposal will not increase the cost of construction, as it does not require the use of demand recirculation water systems. In addition, the ability to use cold-water supply piping as a return pipe may reduce the cost of installing a circulation loop.

CE282-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II-IPC

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

C404.7-EC-KLEIN

CE283-13

C404.7 (NEW), Table C407.5.1(1), Chapter 5, R403.4.3 (NEW) (N1103.5 (NEW)), Chapter 5, IRC P2903.11 (NEW)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE IECC-COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART III WILL BE HEARD BY THE IRC-PLUMBING COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Gerald Van Decker, RenewABILTY Energy Inc., representing self (gerald@renewability.com), Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.7 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Potable water-side pressure loss shall be less than 10 psi at maximum design flow. For Group R occupancies, the efficiency of drain water heat recovery unit efficiency shall be in accordance with CSA 55.1.

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water weating[f,g,h,j]	Fuel type: same as proposed Efficiency: in accordance with Table C404.2 Capacity: same as proposed Where a service water hot water system does not exist or is not specified in the proposed design, a service hot water heating shall not be modeled.	As proposed For Group R, as proposed multiplied by SWHF For other than Group R, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit. As proposed

(Portions of Table not shown remain unchanged)

j. SWHF means service water heat recovery factor. DWHR means drain water heat recovery. The SWHF shall be applied as follows:

= (1 – (DWHR unit efficiency x 0.36))
where potable water from the DWHR unit supplies not less than 1 shower and not greater than 2 showers, of which the drain water from the same showers flows through the DWHR unit.
= (1 – (DWHR unit efficiency x 0.33))
where potable water from the DWHR unit supplies not less than 3 showers and not greater than 4 showers, of which the drain water from the same showers flows through the DWHR unit.
= (1 – (DWHR unit efficiency x 0.26))
where potable water from the DWHR unit supplies not less than 5 showers and not greater than 6 showers, of which the drain water from the same showers flows through the DWHR unit,

= 1.0
where the other conditions are not met.

Add new standards to Chapter 5 as follows:

CSA

CSA 55.1-2012 Test method for measuring efficiency and pressure loss of drain water heat recovery units

CSA 55.2-2012 Drain water heat recovery units

PART II IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R403.4.3 (N1103.4.3) Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Drain water heat recovery units shall be in accordance with CSA 55.1. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi (20.7 kPa) for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi (13.8 kPa) for individual units connected to three or more showers.

Add new standards to Chapter 5 as follows:

CSA

CSA 55.1-2012 Test method for measuring efficiency and pressure loss of drain water heat recovery units

CSA 55.2-2012 Drain water heat recovery units

PART III IRC-P

Add new text as follows:

P2903.11 Drain water heat recovery units. Drain water heat recovery units shall be in accordance with Section N1103.4.3

Reason: There are two reasons for this proposal.1) To enable developers to take credit for efficiency improvements due to the use of drain water heat recovery devices in the performance calculations in the energy code; and 2) to make comparisons of the efficiency of different units based on an existing standard.

Drain water heat recovery (DWHR) works particularly well where heated water flows down the drain at the same time as water flows in that needs to be heated; this "coincident flow" occurs in occupancies with showering and lavatory use. Performance of a DWHR unit is characterized by both efficiency and pressure loss. It is important to ensure that DWHR devices do not impose large pressure losses in the piping in order to minimize the impact on water flow in the building. Given the available DWHR efficiencies, savings are typically 10% to 35% of the energy used for heating water. Over 25,000 drain water heat recovery units have been installed in homes in Canada and the United States.

This change adds two standards for drain water heat recovery units (DWHR units). Drain water heat recovery is often a cost effective way to add to energy efficiency by recapturing hot water energy that is literally "going down the drain". The proposed standards have already been in use by designers for 10 years and the resulting ratings are in use by a variety of energy efficiency programs. Commercial (i.e. non multi-unit residential) applications are engineered systems while multi-unit residential applications are non-engineered and straightforward.

CSA B55.2 standard is for fabrication and material quality of DWHR units. The CSA B55.1 standard is for testing and labeling of DWHR units efficiency and pressure loss at 2.5gpm (9.5lpm). These existing standards were developed through a consensus process by the Canadian Standards Association and are referenced by the Ontario Building Code.

A typical drain water heat recovery unit is shown below:

POWER-PIPE®

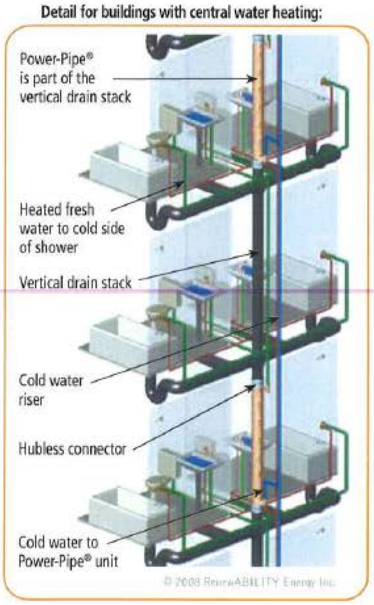
Drain Water Heat Recovery Systems

Reduce Operating Costs for Multi-Unit Residential Buildings

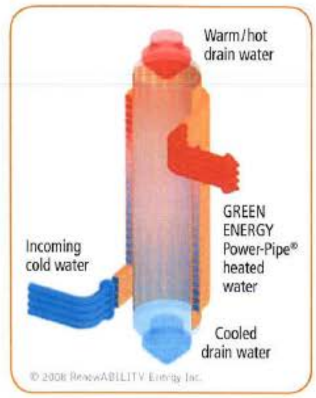
Cost-Effective Green Energy Technology

- The Power-Pipe® is **proven, practical, affordable** and in use today saving energy for thousands of residential suites.
- **Water heating is typically the second highest energy cost** in multi-unit residential buildings; in fact it can even be the highest energy cost.

Detail for buildings with central water heating:



- As building envelopes have become more efficient in recent years water heating has become an even larger portion of the remaining energy costs.
- Much of the drain water leaving a residential building carries with it valuable and recoverable heat energy.
- The all copper Power-Pipe is a double-wall heat exchanger that can **reduce water heating costs by 20-40%** by recovering heat energy from drain (waste) water in multi-residential building drain (waste) stacks.
- The patented and patent pending Power-Pipe design is the only heat exchanger that efficiently allows for up to 4 apartment suites to be plumbed without noticeable loss in water pressure... in fact this results in a **2 to 4 times faster payback** than other heat exchangers.
- The Power-Pipe is very **simple to specify and install** and its savings typically translate to a **3 to 4 year simple payback**; even faster with government or utility incentives.



How It Works

1. As drain water falls down any vertical drain stack it clings to the inner wall, rather than going down the middle of the pipe. This results in a quickly falling thin film.
2. The energy (heat) from this falling film of drain water is easily and efficiently transferred through the copper to the fresh cold water which is flowing around the drain pipe in the outer coils.
3. Cold fresh water is plumbed into the bottom of the Power-Pipe from the main cold water riser.
4. Power-Pipe heated water is then plumbed to either:
   - the cold side of up to 4 showers, for buildings with central water heating, thereby reducing hot water demand
   - the cold side of the shower and water heater, for buildings with in-suite water heaters

877-606-5559
www.renewability.com

Advantages of the Power-Pipe®

- The Power-Pipe® is **very simple to install** during new construction and it integrates with any plumbing system
- The Power-Pipe **can be retrofit** in buildings where there is access to the drain stacks and fresh water lines
- Maintenance-free, 50+ year life
- The Power-Pipe will increase effective hot water capacity, thereby reducing the risk of running out of hot water
- **Quality** is never compromised; the coils of every Power-Pipe unit consist of 100% Type L or heavier copper tube
- The Power-Pipe also provides significant cost-effective **reductions in green house gases** as a result of reduced primary energy demand
- The performance of the Power-Pipe has been **verified by the Canadian Government** *(Ministry of Natural Resources Canada and the University of Waterloo)* in independent third-party testing
- The Power-Pipe will **assist in obtaining LEED Certification** (and similar programs) for your building
- Many Governments and Utilities also offer **financial incentives** resulting in a quicker payback
- The Power-Pipe is the most proven, most used drain water heat recovery technology; many building designers have been specifying the Power-Pipe as a standard in their buildings for many years now, there are now thousands of suites in which Power-Pipes are saving money and energy daily.

Applications Include:

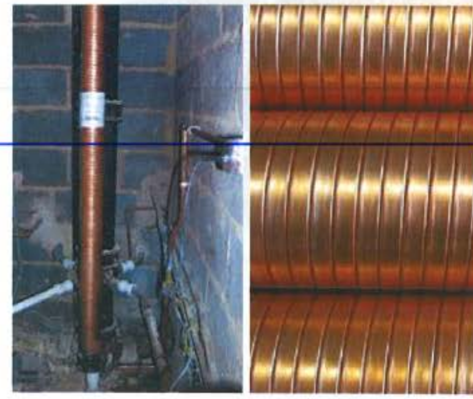
• CONDOMINIUMS	• STUDENT DORMS
• APARTMENT BUILDINGS	• HOSPITALS
• HOTELS	• PRISONS
• AFFORDABLE HOUSING	• TOWNHOUSES

Developed and manufactured by:

RenewABILITY ENERGY INC.

What We Provide:

- We provide free and full support including feasibility analysis, design consultation, CAD drawing elements, and training.
- 10 Year Warranty



Sampling of Projects

Regent Park
Toronto, Ontario
New Construction – Affordable Housing

OMHM
Montreal, Quebec
New Construction – Affordable Housing

University of Toronto
Toronto, Ontario
Student Dorm

University of Oregon
Eugene, Oregon
Student Dorm

Yee Kang Centre
Montreal, Quebec
New Construction – Affordable Housing

Bury Court
Bedford, England
Retrofit – Affordable Housing

Prison
North Bend, Oregon
Retrofit – Government Facility

University of Waterloo
Waterloo, Ontario
Student Townhouses

Adelaide Project
Toronto, Ontario
New Construction – Affordable Housing

Hotel
North Battleford, Saskatchewan
New Construction

National Defense
Halifax, Nova Scotia
Officers Residence

Eastern Oregon University
Eugene, Oregon
Student Dorm

Maison Transitionelle
Montreal, Quebec
New Construction – Affordable Housing

Benny Farms
Montreal, Quebec
LEED Platinum Status and International Award

ETS
Montreal, Quebec
Student Dorm

Cloverdale Housing Coop
Montreal, Quebec
Retrofit – Affordable Housing

ASK ABOUT ENERGY STAR

c UL us

SAVINGS VERIFIED BY Natural Resources Canada

877-606-5559
www.renewability.com

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, CSA B55.1 and B55.2 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE283-13
PART I IECC-COMMERCIAL PROVISIONS

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

PART II IECC- RESIDENTIAL PROVISIONS

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

PART III IRC-P

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

R405.5.2(1)T-EC-VANDECKER.DOC

CE284-13
C404.8 (NEW), C408.1, C408.2, C408.2.3.2, C408.2.4, C408.2.4.1, C408.2.5.2, C408.2.5.4

Proponent: Jeremiah Williams / U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C404.8 Service water heating systems commissioning and completion requirements. *Service water heating systems*, swimming pool water heating systems, spa water heating systems and the controls for those systems shall be commissioned and completed in accordance with Section C408.2.

C408.1 General. This section covers the commissioning of the building mechanical systems in Section C403, service water heating systems in Section C404, and electrical power and lighting systems in Section C405.

C408.2 Mechanical systems and service water heating systems commissioning and completion requirements. Prior to passing the final mechanical and plumbing inspections, the *registered design professional* shall provide evidence of mechanical systems and service water heating systems *commissioning* and completion in accordance with the provisions of this section. Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems and service water heating systems in buildings where the total ~~mechanical~~ equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) combined service water heating and space heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units.

C408.2.3.2 Controls. HVAC and service water heating control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with *approved* plans and specifications.

C408.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner. The report shall be organized with mechanical and service hot water findings in separate sections to allow independent review. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

C408.2.4.1 Acceptance of report. *Buildings*, or portions thereof, shall not pass the final mechanical and plumbing inspections, until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4. HVAC <u>and service hot water</u> controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

C408.2.5.4 Final commissioning report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner ~~and shall include~~. <u>The report shall be organized with mechanical system and service hot water system findings in separate sections to allow independent review. The report shall include the following:</u>

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

Reason: This proposal increases HVAC commissioning scope to also include the building service water heating systems. The value of commissioning a commercial building has been documented and was included for mechanical and lighting systems during the prior code development cycle as a new Section C408 in the IECC. Those provisions are intended to ensure that the building has been "tuned" prior to occupancy to make sure it is properly operating and capable of continuing to operate properly. Many hot water systems have recirculation or heat trace systems that need to be checked to verify that time or other controls are in place to avoid excessive unoccupied piping heat loss. This extends the value and validity of the code provisions because there is little value in requiring something be provided in a building if it is not properly installed and ready to perform its intended function.

The commissioning of the service hot water system is the next logical step in enhancing the value of the IECC. As noted above, there is no reason to add something to the code if there is no review process to make sure it is properly installed and can perform its intended function.

The proposed change expands the scope of mechanical commissioning to include service hot water systems. For buildings not exempt from commissioning, service hot water and mechanical systems are often integrated and the controls and commissioning are likely to be completed by the same parties. For integral tank temperature controls, the commissioning authority can design appropriate simple testing such as a spot check of delivered water temperature to verify proper control operation. The provisions require that the preliminary and final commissioning reports be organized so that mechanical and service hot water results are separate and can be independently reviewed. This will allow mechanical and plumbing inspectors to separately review the results where appropriate.

There is a cost impact associated with this proposed change to the degree that the commissioning activity is currently not being performed and would have to be performed and documented in the proposed change. The cost would be modest, as it could be accomplished by the same staff completing the mechanical commissioning and would be included in the same commissioning report. There should also be a decrease in costs because such commissioning reduces the burden on state and local government to ensure and document compliance with the code. Without commissioning to ensure the code-required controls and other systems are in place, the cost effectiveness of other energy code provisions is in jeopardy. A study of 643 commissioned building in 26 states found that new building commissioning had a median payback of 4.2 years.

References:

Evan Mills. 2009. Building Commissioning: A golden opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions. http://cx.lbl.gov/2009-assessment.html

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

CE284-13

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

C404.8 (NEW)-EC-WILLIAMS.DOC

CE285 – 13
C202, C405.1, R202 (IRC N1109.1) R404.1 (IRC N1104.1)

Proponent: Deborah Frankhouser, Four Point Lighting Design, representing the International Association of Lighting Designers (deborah@fourpointlighting.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY THE RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE.

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, and minimum acceptable lighting equipment for exterior applications.

> **Exception:** Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that they comply with Section R404.1. ~~not less than 75 percent of the permanently installed light fixtures, other than low voltage lighting, shall be fitted for, and contain only, high efficacy lamps.~~

Delete definition without substitution as follows:

SECTION C202
GENERAL DEFINITIONS

~~**HIGH-EFFICACYLAMPS.** Compact fluorescent lamps, T-8 or smaller diameter fluorescent lamps, or lamps with a minimum efficacy of:~~

1. ~~60 lumens per watt for lamps over 40 watts,~~
2. ~~50 lumens per watt for lamps over 15 watts to 40 watts,~~
3. ~~40 lumens per watt for lamps 15 watts or less.~~

PART II – IECC-RESIDENTIAL PROVISIONS

Revise as follows:

R404.1 (N1104.1) Lighting equipment (Mandatory). ~~A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or a minimum of 75 percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.~~ All permanently installed lighting shall be *high efficiency luminaires*.

> **Exception:** ~~Low-voltage lighting shall not be required to use high-efficiency lamps.~~
>
> 1. Luminaires that utilize lamps that operate at less than 25 volts if separately controlled by a dimmer or an *automatic* control device and controlled separately from *high-efficiency luminaires.*
> 2. Up to 50 percent of the luminaires not qualifying for Exception 1 shall be permitted to be other than *high-efficiency luminaires* if they are controlled by a dimmer or *automatic* control device*.* *High- efficiency luminaires* shall be controlled separately from non *high-efficiency luminaires*.

Revise definition as follows:

SECTION R202 (N1101.9)
GENERAL DEFINITIONS

HIGH-EFFICIENCY ~~EFFICACY~~ ~~LAMPS~~ LUMINAIRES. Luminaires containing only compact fluorescent lamps, T-8 or smaller diameter fluorescent lamps with electronic ballasts, or lamps or light emitting diodes (LED's) with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts,
2. 50 lumens per watt for lamps over 15 watts to 40 watts,
3. 40 lumens per watt for lamps 15 watts or less.

Reason: (Part I) The exception to C405.1 establishes a different standard for lighting efficiency in dwellings from Section R404.1. Section C405.1 is a luminaire-based standard, whereas Section R404.1 is a lamp-based standard. There is no reason for the code to set an efficiency standard for lighting within dwelling units in multi-family buildings that is different from the standard for lighting in detached houses. Residential lighting is the same regardless of the building it is located in.
(Part II):

1. Increases the overall requirement for high-efficiency luminaires from 75% to 100% with certain exceptions designed to save energy and provide maximum flexibility to designers, owners and code officials.
2. Changes the Chapter 2 definitions from *high efficacy lamps* to *high efficiency luminaires* as determined by lamp efficacy. This means owners, designers, and building code officials would count luminaires (light fixtures) vs. counting light bulbs to determine the amount of high or low efficient lighting on a project. Luminaires often have multiple lamps, making counting more cumbersome for both the owner/designer as well as the code official. By counting luminaires, the code official simply has to identify lamp type, but doesn't have to count individual lamps within each luminaire.
3. Allows for an optional and more flexible energy savings approach for owners and designers by allowing up to 50% low efficiency luminaires as long as lighting controls are used to reduce or turn off the low efficiency luminaires.

   The current code requires 75% of lighting to be *high-efficacy.* However, there is a high amount of dissatisfaction with compact fluorescents because of their poor color, noise, incompatibility with dimming, and mercury content. (Reference, Dept. of Energy's "Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market," prepared by Pacific Northwest National Laboratory, June 2006) LED technology is still emerging and many of the inexpensive LED's continue to have poor color and incompatibility with dimming.

   The most efficient light is the one that is off. The current code does not use lighting controls as a means of energy savings. Regardless of efficacy, light sources achieve maximum energy savings when they are off or reduced to the minimum required by the task. For 120 volt incandescent/halogen sources, dimming reduces energy use, increases lamp life, and dimmers are inexpensive. Automatic controls turn lighting off when not being used. (See reference documentation listed below.)

   Cost implications: In most cases, the required high efficiency Fluorescent and LED light fixtures are more expensive than their low efficiency 120 volt incandescent equivalents simply because fluorescent and LED have additional required components such as ballasts and drivers. Dimmers vary significantly in cost, but a 120v incandescent dimmer can be purchased for as little as $15. When installed with the less expensive 120v incandescent lighting, this combination can be less expensive than purchasing many fluorescent or LED versions controlled by a switch. There are many options for owners and adding dimmers does not necessarily equal adding dollars when comparing low efficiency and high efficiency luminaires. Also, in residential, dimming is important for reasons other than energy savings and dimming fluorescent and LED sources can significantly increase dimming costs.

   Residential is not commercial. In residences, it is very common for decorative lighting to be the main lighting source in a room. Decorative chandeliers are often only available in120v incandescent medium or candelabra based sockets. Often times these chandeliers exceed the current allowance (25%) even when using high efficacy light sources for other types of architectural lighting such as down lights, task lighting, etc. These fixtures do not qualify for the Low Voltage Exception currently in the code. The proposed Exception 2 gives a greater allowance for 120v incandescent/halogen luminaires than the current code allows to accommodate these decorative products, but encourages energy savings through the use of controls.
4. Clarifies the low voltage lighting exception currently in the code and adds stringency by requiring lighting controls as an energy savings approach for these light fixture types. The current code allows for the use of low voltage with no limits. They are lower in VOLTAGE not WATTAGE. Adding controls will increase the overall energy efficiency of these products.

References

Several reports document savings from using controls residentially, such as:

- http://www.lrc.rpi.edu/programs/lightingTransformatio/economics/table2.asp [shows 20% to 40% savings depending on space type for using occupancy sensors]
- http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Lighting/ open Residential Lighting PDF and see page 32 [shows 10% savings from dimmers, 30% savings from occupancy sensors]
- Heschong Mahone Group Lighting Efficiency Technology Report Vol. 1, see page 83. www.energy.ca.gov/efficiency/lighting/VOLUME01.PDF [shows 20% savings from dimmers and 54% savings from occupancy sensors]

Cost Impact: The code change proposal will not increase the cost of construction.

CE285-13
PART I – IECC-COMMERCIAL PROVISIONS

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

PART II – IECC-RESIDENTIAL PROVISIONS

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

C405.1-EC-FRANKHOUSER.doc

CE286 – 13
C405.1, C405.8 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, controls for electric receptacles, and minimum acceptable lighting equipment for exterior applications.

> **Exception:** Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that not less than 75 percent of the permanently installed light fixtures, other than low voltage lighting, shall be fitted for, and contain only, high efficacy lamps.

C405.8 Automatic receptacle control. Automatic controls shall be provided for at least 50 percent of the 125 volt 15- and 20-Ampere receptacles in private offices, computer classrooms and individual workstations and receptacles associated with branch circuit feeds that are installed to supply electrical power to modular furniture in such spaces. These receptacles shall be labeled “Automatic Control Receptacle”. The automatic controls shall:

1. Be capable of operating on a scheduled basis using a time-of-day operated control device that will turn receptacles off at specific programmed times and provide for an independent program schedule for areas not larger than 25,000 square feet but not larger than one floor, or
2. Be an occupant sensor that is capable of turning receptacles off within 30 minutes of all occupants leaving a *space*, or
3. Be capable of providing a signal to another control or alarm system that indicates the area is unoccupied.

> **Exceptions:** Automatic receptacle controls need not be provided for:
>
> 1. Receptacles specifically designated for equipment requiring 24 hour operation.
> 2. Spaces where an automatic shutoff would endanger the safety or security of the room or building occupants.

Reason: Energy is used in supplying power to receptacles in offices, computer classrooms, individual work stations and modular furniture in such spaces. As with occupancy sensors that can reduce energy use associated with lighting and mechanical ventilation, the equipment supported by electrical receptacles is also subject to use and non-use based on occupancy. ASHRAE/IES Standard 90.1, which is adopted by reference in the IECC Commercial Provisions, contains provisions to provide for at least half of the electrical receptacles in certain spaces to have automatic controls as enhanced by addendum v to the standard. This change ensures consistency between the IECC Commercial Provisions and the latest criteria in standard 90.1.

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

CE286-13

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

C405.1-EC-FERGUSON.doc

CE287 – 13

C202 (NEW), C405.2, C405.2.1, C405.2.1.1, C405.2.2, C405.2.2.1, C405.2.1.1, C405.2.1.2, C405.2.2, C405.2.2.1, C405.2.2.3, C405.2.2.3.1, C405.2.2.3.2, C405.2.2.3.3, C405.2.3, C405.2.4

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C405.2 Lighting Controls (Mandatory). Lighting systems shall be provided with controls as specified in Sections C405.2.1, C405.2.2, C405.2.3, ~~and~~ C405.2.4, and C405.2.5.

Exceptions: Lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted;
2. Stairways and corridors; and
3. Emergency egress lighting that is normally off.

~~**C405.2.1 Manual lighting controls.** All buildings shall include manual lighting controls that meet the requirements of Sections C405.2.1.1 and C405.2.1.2.~~

~~**C405.2.2.2**~~ **C405.2.1 Occupant** ~~**sensors**~~ **sensor controls.** *Occupant* ~~sensors~~ *sensor controls* shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions. ~~These automatic control devices shall be installed to~~

C405.2.1.1 Occupant sensor control function. Occupant sensor controls shall comply with the following:

1. Automatically turn off lights within 30 minutes of all occupants leaving the space; ~~and~~
2. Shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power; and
3. Shall incorporate a *manual control* to allow occupants to turn lights off.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants

~~**C405.2.1.1 Interior lighting controls.** Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.~~

~~**Exceptions:**~~

1. ~~Areas designated as security or emergency areas that need to be continuously lighted.~~
2. ~~Lighting in stairways or corridors that are elements of the means of egress.~~

C405.2.2 ~~**Additional lighting**~~ **Time switch controls.** ~~Each area that is required to have a manual control shall also have controls that meet the requirements of Sections C405.2.2.1, C405.2.2.2 and C405.2.2.3.~~ Each area of the building that is not provided with *occupant sensor controls* complying with Section C405.2.1.1 shall be provided with *time switch controls* complying with Section C405.2.2.1.

Exceptions: Where a *manual control* provides light reduction in accordance with Section C405.2.2.2, automatic controls ~~additional lighting controls~~ ~~need not be provided~~ shall not be required for the following:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation.

C405.2.2.1 ~~Automatic~~ Time switch control ~~devices~~ function. ~~Automatic time switch controls shall be installed to control lighting in all areas of the building.~~ Each space provided with *time switch controls* shall also be provided with a *manual control* for light reduction in accordance with Section C405.2.2.2. *Time switch controls* shall include an override switching device that complies with the following:

~~**Exceptions:**~~

1. ~~Emergency egress lighting does not need to be controlled by an automatic time switch.~~
2. ~~Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls.~~

~~The automatic time switch control device shall include an override switching device that complies with the following:~~

1. The override switch shall be a *manual control* ~~in a readily accessible location;~~
2. ~~The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;~~
3. ~~The override switch shall permit manual operation;~~

2. ~~4.~~ The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum duration of 2 hours; and
3. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

Exceptions:

1. Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:
   - ~~1.~~ 1.1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
   - ~~2.~~ 1.2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).
2. Where provided with *manual control*, the following areas are not required to have light reduction control:
   - 2.1. Spaces that have only one luminaire with a rated power of less than 100 watts;
   - 2.2. Spaces that use less than 0.6 watts per square foot (6.5 W/m^2); and
   - 2.3. Corridors, equipment rooms, public lobbies, electrical or mechanical rooms.

~~C405.2.1.2~~ C405.2.2.2 Light reduction controls. ~~Each area that is required to have a manual control shall also allow the occupant to~~ Spaces required to have light reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *approved* methods:

1. Controlling all lamps or luminaires;
2. Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps;
3. Switching the middle lamp luminaires independently of the outer lamps; or
4. Switching each luminaire or each lamp.

Exception: Light reduction controls ~~need not be provided in the following areas and spaces:~~ are not required in daylight zones with *daylight responsive controls* complying with C405.3.2.

1. ~~Areas that have only one luminaire, with rated power less than 100 watts.~~
2. ~~Areas that are controlled by an occupant-sensing device.~~
3. ~~Corridors, equipment rooms, storerooms, restrooms, public lobbies, electrical or mechanical rooms.~~
4. ~~Sleeping unit (see Section C405.2.3).~~
5. ~~Spaces that use less than 0.6 watts per square foot (6.5 W/m^2).~~
6. ~~Daylight spaces complying with Section C405.2.2.3.2.~~

C405.2.2.3 Manual controls. *Manual controls* for lights shall meet the following requirements:

1. Shall be readily accessible to occupants; and
2. Shall be located where the controlled lights are visible; or the control shall identify the area served by the lights and indicate their status.

~~C405.2.2.3~~ C405.3 Daylight zone control. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.1~~ C405.3.1 Manual daylight controls. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.2 Automatic daylight controls.~~ C405.3.2 Daylight responsive controls. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.3~~ C405.3.3 Multi-level lighting controls. *(Portions of text not shown remains unchanged)*

~~C405.2.3~~ C405.2.4 Specific application controls. *(Portions of text not shown remains unchanged)*

~~C405.2.4~~ C405.2.5 Exterior lighting controls. *(Portions of text not shown remains unchanged)*

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

TIME SWITCH CONTROL. An automatic control device or system that controls lighting or other loads, including switching off, based on time schedules.

OCCUPANT SENSOR CONTROL. An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

Reason: This public comment is submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 2 open meetings and over 15 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this proposal are as follows:

Overview:

This proposal reorganizes, but does not delete requirements related to lighting controls in the 2012 IECC.

Section C405.2 of the 2012 IgCC is confusing. It puts information that is often irrelevant first, and surprises with essential and relevant information only after one has suffered through trying to decipher what the implications of the irrelevant information might be. Section C405.2 also contains redundant information and the relationship of various subsections of C405.2 to one another is often unclear and ambiguous. This proposal reorganizes Section C405.2 to provide the clarity that is necessary for its proper application and enforcement. This proposal is a reorganization only and does not contain technical changes or increases or decreases in stringency.

Section C405.2:

According to the IBC, all interior stairways and corridors are elements of the means of egress. The original intent of this language may have been to exempt corridors and stairways which are part of an exit as defined by the IBC, but the way the code is currently written it also exempts exit access and exit discharge components, i.e. the entire building. Exceptions 1 and 2 are moved here from deleted former Section C405.2.1.1.

Proposed Exception 3 to Section C405.2:

"Emergency egress lighting that is normally off" does not seem to be exempt from controls requirements in the current code, but it needs to be.

Section C405.2.1.1:

This proposal deletes existing Section C405.2.1.1 and replaces it with new text. The way the code is currently structured most users probably would not realize that a manual switch is always required, even with automatic-on occupant sensors. This clarifies the fact that a manual switch is always required.

Exception to Proposed Section C405.1.1:

Former Section C405.2.2 is proposed to be moved and split into two sections: Sections C405.2.1 and C405.2.1.1. The requirements under proposed new Section C405.2.1.1 have been itemized for clarity. Note that the requirement for occupant sensor controls in "other spaces 300 square feet or less" is extremely broad and will encompass all of the lighting on smaller projects. For example, this is applicable to sleeping units, dwelling units, etc. Whether or not this was the original intention, this is how the code currently reads, and this proposal is intended to provide clarity, it is not intended to make technical changes.

Exception 1 to Section C405.2.2:

Note that the current code does not offer an exception for dwelling units. Dwelling units that are not exempt from all of 405.2 are required to comply with the requirements for automatic controls and light reduction controls.

Exception 4 to Section C405.2.2:

The exception that is currently in the code is for "lighting" that is intended for continuous operation, not for "spaces". This is an important distinction, because it allows light fixtures that are intended for night lighting of unoccupied spaces to be left off the automatic control system (like retail stores for security reasons, where select lights might be left on all night long.

The current code does not offer a blanket exemption for continuously operational emergency egress "night" lighting. Under current code, all emergency egress lighting that is not located in a corridor or stairwell must have a manual control device for override, even though it does not need to be automatically controlled.

Exception 2 to Section C405.2.1 and Section C405.2.1.2:

This exception is derived from 2012 IECC Section C405.2.1.2, which this proposal deletes. Storerooms and restrooms should not be in this list because they are required to be provided with occupant sensor controls.

Sections C405.2.1.1, C405.2.2.1 and C405.2.2.3:

This new section is a combination of the requirements in existing Sections C405.2.1.1 and C405.2.2.1 that pertain to manual controls. Therefore, existing Section C405.2.1.1 is proposed to be deleted and Section C405.2.2.1 is proposed to be revised. Existing Section C405.2.2.3 is not replaced, it is renumbered, as are all affected subsequent sections.

Please note that the SEHPCAC has also submitted other proposals that are coordinated with this proposal and are intended to clarify and improve the usability of the code's prescriptive building thermal envelope provisions. This proposal, however, is intended to stand alone and is not contingent upon the success of other SEHPCAC proposals.

Cost Impact: The code change proposal will not increase the cost of construction. This proposal is a clarification and, as such, will not increase the cost of construction.

CE287-13

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

C405.2-EC-THOMPSON-SEHPCAC

CE288 – 13

C202 (NEW), C405.2, C405.2.1, C405.2.1, C405.2.1.1, C405.2.2, C405.2.2.1, C405.2.2.2, C405.2.2.3 (NEW)

Proponent: Don Iverson, National Electrical Manufacturers Association (don.iverson@nema.org)

Revise as follows:

C405.2 Lighting controls (Mandatory). Lighting systems shall be provided with controls as specified in Sections C405.2.1, C405.2.2, C405.2.3, ~~and~~ C405.2.4, and C405.2.5.

Exceptions: Lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted;
2. Stairways and corridors.
3. Emergency egress lighting that is normally off.

~~**C405.2.1 Manual lighting controls.** All buildings shall include manual lighting controls that meet the requirements of Sections C405.2.1.1 and C405.2.1.2.~~

~~**C405.2.2.2 Occupancy sensors.**~~ **C405.2.1 Occupant sensor controls.** ~~Occupancy sensors~~ *Occupant sensor controls* shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less enclosed by floor-to-ceiling height partitions. ~~These automatic control devices shall be installed to~~

C405.2.1.1 Occupant sensor control function. Occupant sensor controls shall comply with all of the following:

1. Automatically turn off lights within 30 minutes of all occupants leaving the space; ~~and~~
2. Shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power.
3. Shall incorporate a *manual* control to allow users to turn lights off.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants

~~**C405.2.1.1 Interior lighting controls.** Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.~~

~~**Exceptions:**~~

1. ~~Areas designated as security or emergency areas that need to be continuously lighted.~~
2. ~~Lighting in stairways or corridors that are elements of the means of egress.~~

C405.2.2 ~~**Additional lighting**~~ **Time switch controls.** ~~Each area that is required to have a manual control shall also have controls that meet the requirements of Sections C405.2.2.1, C405.2.2.2 and C405.2.2.3.~~ Each area of the building that is not provided with *occupant sensor controls* complying with Section C405.2.1.1 shall be provided with *time switch controls* complying with Section C405.2.2.1.

Exceptions: Where a *manual* control provides light reduction in accordance with Section 405.2.2.2, additional lighting controls ~~need not be provided~~ shall not be required for the following:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation.

C405.2.2.1 ~~Automatic~~ Time switch control ~~devices~~ function. Automatic time switch controls shall be installed to control lighting in all areas of the building. Each space provided with *time switch controls* shall also be provided with a *manual control* for light reduction in accordance with Section 405.2.2.2. *Time switch controls* shall include an override switching device that complies with the following:

Exceptions:

1. Emergency egress lighting does not need to be controlled by an automatic time switch.
2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls.

The automatic time switch control device shall include an override switching device that complies with the following:

1. The override switch shall be ~~in a readily accessible location;~~ a *manual* control.
~~2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;~~
~~3. The override switch shall permit manual operation;~~
~~4.~~ 2. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum duration of 2 hours; and
~~5.~~ 3. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

Exceptions:

1. Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:
   ~~1.~~ 1.1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
   ~~2.~~ 1.2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).
2. Where provided with *manual* control, the following areas are not required to have light reduction control:
   2.1. Spaces that have only one luminaire, with rated power less than 100 watts;
   2.2. Spaces that use less than 0.6 watts per square foot (6.5 W/m^2); and
   2.3. Corridors, equipment rooms, public lobbies, electrical or mechanical rooms.

~~C405.2.1.2~~ C405.2.2.2 Light reduction controls. ~~Each area that is required to have a manual control shall also allow the occupant~~ Spaces required to have light reduction controls shall have a *manual* control that allows the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *approved* methods:

1. Controlling all lamps or luminaires;
2. Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps;
3. Switching the middle lamp luminaires independently of the outer lamps; or
4. Switching each luminaire or each lamp.

Exception: Light reduction controls ~~need not be provided in the following areas and spaces:~~ are not required in daylight zones with *daylight responsive controls* complying with C405.3.2.

1. ~~Areas that have only one luminaire, with rated power less than 100 watts.~~
2. ~~Areas that are controlled by an occupant-sensing device.~~
3. ~~Corridors, equipment rooms, storerooms, restrooms, public lobbies, electrical or mechanical rooms.~~
4. ~~*Sleeping unit* (see Section C405.2.3).~~
5. ~~Spaces that use less than 0.6 watts per square foot (6.5 W/m^2).~~
6. ~~Daylight spaces complying with Section C405.2.2.3.2.~~

C405.2.2.3 Manual controls. *Manual* controls for lights shall comply with the following:

1. Controls shall be readily accessible to occupants; and
2. Controls shall be located where the controlled lights are visible; or the control shall identify the area served by the lights and indicate their status.

~~C405.2.2.3~~ C405.3 Daylight zone control. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.1~~ C405.3.1 Manual daylight controls. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.2 Automatic daylight controls.~~ C405.3.2 Daylight responsive controls. *(Portions of text not shown remains unchanged)*

~~C405.2.2.3.3~~ C405.3.3 Multi-level lighting controls. *(Portions of text not shown remains unchanged)*

~~C405.2.3~~ C405.2.4 Specific application controls. *(Portions of text not shown remains unchanged)*

~~C405.2.4~~ C405.2.5 Exterior lighting controls. *(Portions of text not shown remains unchanged)*

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

TIME SWITCH CONTROL. An automatic control device or system that controls lighting or other loads, including switching off, based on time schedules.

OCCUPANT SENSOR CONTROL. An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

Reason:
1. An extensive reorganization of C405.2 is proposed to improve readability and clarify use cases
2. For C405.2 Exceptions**:**
   a. According to the IBC, all interior stairways and corridors are elements of the means of egress. The original intent of this language may have been to exempt corridors and stairways which are part of an exit as defined by the IBC, but the way the code is currently written it also exempts exit access and exit discharge components, i.e. the entire building. Exceptions 1 and 2 are moved here from deleted former Section C405.2.1.1.
   b. Emergency egress lighting does not seem to be exempt from controls requirements in the current code, but it needs to be.
3. For C405.2.1.1.3: The way the code is currently structured most users probably would not realize that a manual switch is always required, even with automatic-on occupancy sensors.
4. Former Section C405.2.2 is proposed to be moved and split into two sections: Sections C405.2.1 and C405.2.1.1. The requirements under proposed new Section C405.2.1.1 have been itemized for clarity. Note that the requirement for occupant

sensor controls in “other spaces 300 square feet or less” is extremely broad and will encompass all of the lighting on smaller projects. For example, this is applicable to sleeping units, dwelling units, etc.

5. For C405.2.2 Exceptions:
   a. The current code does not offer an exception for dwelling units. Dwelling units that are not exempt from all of 405.2 are required to comply with the requirements for automatic controls and light reduction controls.
   b. The exception that is currently in the code is for “lighting” that is intended for continuous operation, not for “spaces”. This is an important distinction, because it allows light fixtures that are intended for night lighting of unoccupied spaces to be left off the automatic control system (like retail stores for security reasons, where select lights might be left on all night long. The current code does not offer a blanket exemption for continuously operational emergency egress “night” lighting. Under current code, all emergency egress lighting that is not located in a corridor or stairwell must have a manual control device for override, even though it does not need to be automatically controlled.
6. For C405.2.2.1 Exceptions: Exception 2 is derived from 2012 IECC Section C405.2.1.2, which this proposal deletes. Storerooms and restrooms should not be in this list because they are required to be provided with occupant sensor controls
7. For C405.2.2.3 Manual Controls, these additions Refer to C405.2.1.1 and C405.2.2.1 in these two sections.

Cost Impact: This code change proposal will not increase the cost of construction.

CE288-13

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

C405.2-EC-IVERSON.doc

CE289 – 13
C405.2.1.1

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

C405.2.1.1 Interior lighting controls. Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.

Exceptions:

1. Areas designated as security or emergency areas that need to be continuously lighted.
2. Lighting in stairways or corridors that are exits or exit discharge elements ~~of the means of egress~~.

Reason: According to the IBC 2012, all interior stairways and corridors are elements of the means of egress (most are exit access components). This makes the current code language redundant and confusing.

Most users of the code interpret this exception to apply only to stairways and corridors that are part of exits, and this was probably the original intention of the language. Interior exit discharge elements are unusual, but are allowed by IBC 2012 Section 1027.1.

The proposed change will make this section of the code technically correct and consistent with other ICC family codes.

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

CE289-13

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

C405.2.1.1-EC-BAILEY.doc

CE290 – 13
C405.2.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.2.2 Additional lighting controls. Each area that is required to have a manual control shall also have controls that meet the requirements of Sections C405.2.2.1, C405.2.2.2 and C405.2.2.3.

Exception: Additional lighting controls need not be provided in the following spaces:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation
5. <u>Shop and laboratory classrooms</u>.

Reason: Currently, lighting controls are required in shop and laboratory classrooms. These spaces are similar to spaces where patient care is directly provided, however there are instances (in a classroom setting) where lighting controls are not needed, but no patient care is being provided. This exception is consistent with ANSI/ASHRAE/IES Standard 90.1.

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

CE290-13

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

C405.2.2-EC-FERGUSON.doc

CE291 – 13
C405.2.2.1

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.1 Automatic time switch controls ~~devices~~. Automatic time switch controls shall be installed to control lighting in all areas of the building.

Exceptions:

1. Emergency egress lighting does not need to be controlled by an automatic time switch.
2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls.

~~The~~ Automatic time switch controls ~~device~~ shall comply with the following:

1. Have a minimum 7 day clock;
2. Be capable of being set for 7 different day types per week;
3. Incorporate an automatic holiday "shut-off" feature, which turns off all controlled lighting loads for at least 24 hours and then resumes normally scheduled operations.
4. Have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted; and
5. Include an override switch ~~device~~ that complies with the following:
   - 5.1. The override switch shall be in a readily accessible location;
   - 5.2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;
   - 5.3. The override switch shall permit manual operation;
   - 5.4. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum of 2 hours; and
   - 5.5. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

     Exception: Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:

     1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
     2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).

Reason: These additional details clarify that a 7-day clock and holiday override features are required. This prevents lights from automatically turning on during weekends and holidays if not needed, and allows customization for unique schedules that require lighting earlier or later than usual on certain days, without keeping lights on for those extra hours on the other days of the week. The word "devices" is unnecessary and deleted for consistency in the language.

Washington State's experience has been that the power-loss memory feature is invaluable in restoring normal operations after a brief power interruption, at little extra cost.

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

CE291-13

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

C405.2.2.1-EC-NOGLER.doc

CE292 – 13
C405.2.2.2

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.2 Occupancy sensors. Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, <u>warehouse spaces</u>, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less enclosed by floor-to-ceiling height partitions. These automatic control devices shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, and shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power.

> **Exception:** Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants

Reason: This provision adds warehouses to the list of areas requiring occupancy sensors for lighting control. Since most areas in a warehouse are unoccupied most of the time, while other spaces are in use, the savings on lighting energy are substantial. This has been an integral part of the Washington State Energy Code for many years.

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

CE292-13

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

C405.2.2.2-EC-NOGLER.doc

CE293 – 13
C405.2.2.2, C405.2.2.2.1 (NEW), C405.2.2.2.2 (NEW)

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers, (glenn@lampartners.com). James Edelson, New Buildings Institute.

Revise as follows:

C405.2.2.2 Occupancy sensor~~s~~ controls. Occupancy sensors shall be installed to control lights in accordance with C405.2.2.2.1 and C405.2.2.2.2. These automatic control devices shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, and shall either be manual-on or shall be controlled to automatically turn the lighting on to not more than 50 percent power.

Exception: Full automatic-on controls shall be permitted to control lighting in:

1. Public corridors,
2. Stairways,
3. Restrooms,
4. Primary building entrance areas and lobbies,
5. Parking garages,
6. Warehouses,
7. Areas where manual-on operation would endanger the safety or security of the room or building occupants.

C405.2.2.2.1. Occupancy sensors for 100 percent load control. Occupancy sensors shall be installed to control 100 percent of the connected lighting load in:

1. Classroom~~s~~/lecture/training rooms,
2. Conference/meeting ~~rooms~~/multi-purpose rooms,
3. Copy/print rooms,
4. Lounges,
5. Employee lunch and-break rooms,
6. Private offices,
7. Restrooms,
8. Storage rooms, ~~and~~
9. Janitorial closets,
10. Laboratory classrooms,
11. Locker rooms,
12. Other spaces 300 square feet (28 m^2) or less enclosed by floor-to-ceiling height partitions.

C405.2.2.2.2. Occupancy sensors for 50 percent load control. Occupancy sensors shall be installed to control not less than 50 percent of the connected lighting load in:

1. Enclosed stairways,
2. Parking garages,
3. Warehouses.

Reason: Occupancy sensors are the automatic control type that leads to the most energy savings. This proposal requires the use of occupancy sensors in certain additional space types where occupancy sensors can be used effectively. The space type names are consistent with the space type names used for determination of lighting power density. The phrase "to control lights" is added to make it clear that the sensors not only have to be installed, but have to function. The section has been reformatted in list format for clarity.

Cost Impact: This code change proposal will increase the cost of construction if occupancy sensors would not already be specified for the space types not currently in the code.

CE293-13

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

C405.2.2.2-EC-HEINMILER.doc

CE294 – 13

C202, Figure C405.1 (NEW), Figure C405.2 (NEW), C405.2.2.3, C405.2.2.3.1 (NEW), C405.2.2.3.2 (NEW), C405.2.2.3.3 (NEW), Figure C405.3 (NEW), Figure C405.4 (NEW)

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com), Jim Edelson, New Buildings Institute (jim@newbuildings.org)

Revise as follows:

~~**C405.2.2.3 Daylight zone control.** Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with either Section C405.2.2.3.1 or Section C405.2.2.3.2. Each daylight control zone shall not exceed 2,500 square feet (232 m²). Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e., north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.~~

> ~~**Exception:** Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.~~

C405.2.2.3 Daylight responsive controls. *Daylight responsive controls* complying with Section C405.2.2.3.1 shall be provided to control the electric lights within *daylight zones* in the following spaces:

1. Spaces with a total of more than 150 watts of *general lighting* within sidelight *daylight zones* complying with Section C405.2.2.3.2*. General lighting* does not include lighting that is required to have specific application control in accordance with Section C405.2.3.
2. Spaces with a total of more than 150 watts of *general lighting* within toplight *daylight zones* complying with Section C405.2.2.3.3.

Exceptions: Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.
2. Dwelling units and sleeping units.
3. Lighting that is required to have specific application control in accordance with Section C405.2.3.

C405.2.2.3.1 Daylight responsive control function. Where required, *daylight responsive controls* shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in toplight *daylight zones* in accordance with Section C405.2.2.3.3 shall be controlled independently of lights in sidelight *daylight zones* in accordance with Section C405.2.2.3.2;
2. *Daylight responsive controls* within each space shall be configured so that they can be calibrated from within that space by authorized personnel;
3. Calibration mechanisms shall be *readily accessible*;
4. When located in offices, classrooms, laboratories, and library reading rooms, *daylight responsive controls* shall dim lights continuously from full light output to 10 percent of full light output or lower;
5. *Daylight responsive controls* shall be capable of a complete shut off of all controlled lights; and
6. Lights in sidelight *daylight zones* in accordance with Section C405.2.2.3.2 facing different cardinal orientations (i.e. within 45 degrees of due north, east, south, west) shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

C405.2.2.3.2 Sidelight daylight zone. The sidelight *daylight zone* is the floor area adjacent to vertical *fenestration* which complies with all of the following:

1. Where the *fenestration* is located in a wall, the *daylight zone* shall extend laterally to the nearest full height wall, or up to 1.0 times the height from the floor to the top of the *fenestration*, and longitudinally from the edge of the fenestration to the nearest full height wall, or up to 2 feet (610 mm), whichever is less, as indicated in Figure C405.1;
2. Where the *fenestration* is located in a rooftop monitor, the *daylight zone* shall extend laterally to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 1.0 times the height from the floor to the bottom of the *fenestration*, whichever is less, and longitudinally from the edge of the *fenestration* to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.25 times the height from the floor to the bottom of the *fenestration*, whichever is less, as indicated in Figures C405.2 and C405.3;
3. The area of the *fenestration* is at least 24 square feet;
4. The distance from the *fenestration* to any building or geological formation which would block access to daylight is greater than the height from the bottom of the *fenestration* to the top of the building or geologic formation; and
5. Where located in existing buildings, the *visible transmittance* of the *fenestration* is no less than 0.25.

C405.2.2.3.3 Toplight daylight zone. The toplight *daylight zone* is the floor area underneath a roof *fenestration* assembly which complies with all of the following:

1. The *daylight zone* shall extend laterally and longitudinally beyond the edge of the roof *fenestration* assembly to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.7 times the ceiling height, whichever is less, as indicated in Figure C405.4;
2. No building or geological formation blocks direct sunlight from hitting the roof *fenestration* assembly at the peak solar angle on the summer solstice; and
3. Where located in existing buildings, the product of the *visible transmittance* of the roof *fenestration* assembly and the area of the rough opening of the roof fenestration assembly, divided by the area of the daylight zone is no less than 0.008.

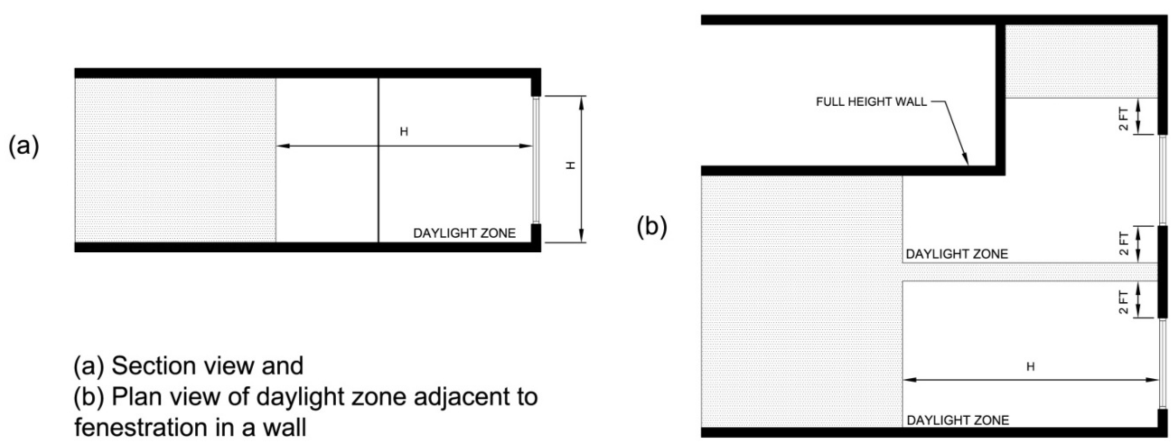


FIGURE C405.1
***DAYLIGHT ZONE* ADJACENT TO FENESTRATION IN A WALL**

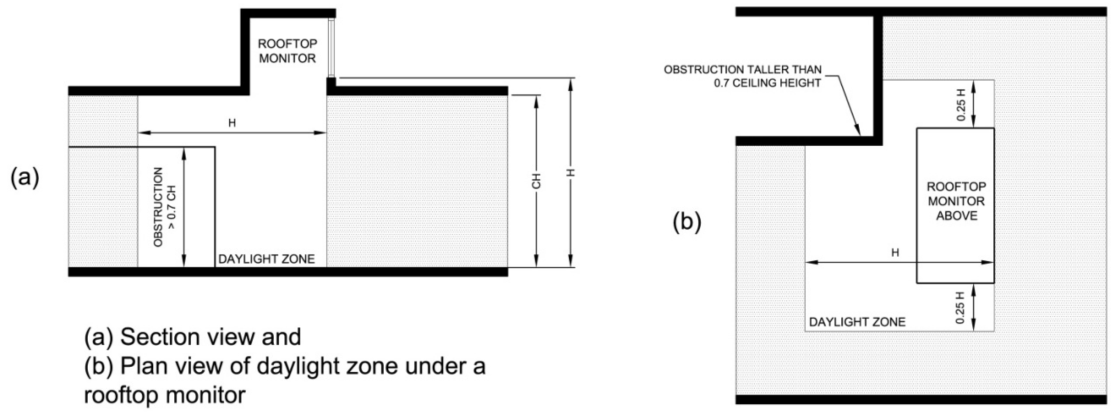


FIGURE C405.2
***DAYLIGHT ZONE* UNDER A ROOFTOP MONITOR**

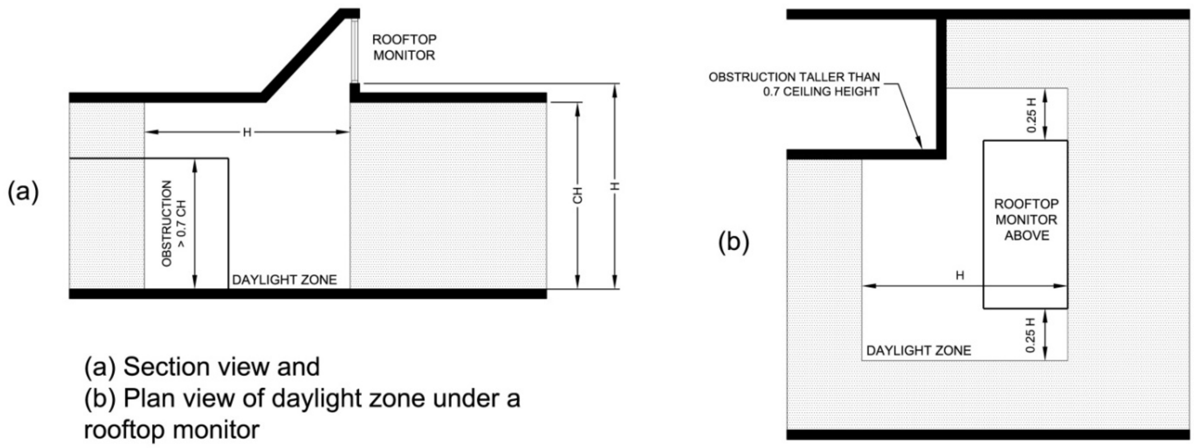


FIGURE C405.3
***DAYLIGHT ZONE* UNDER A SLOPED ROOFTOP MONITOR**

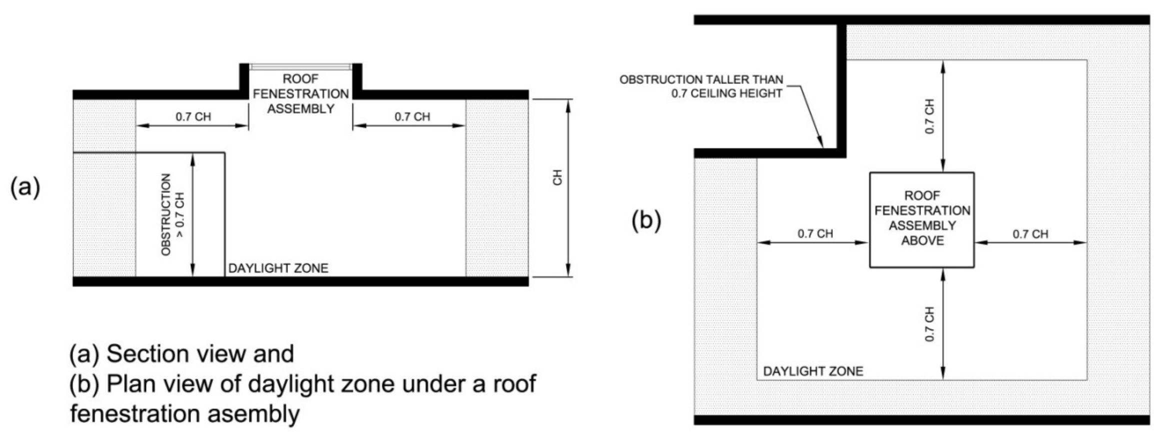


FIGURE C405.4
***DAYLIGHT ZONE* UNDER A ROOF FENESTRATION ASSEMBLY**

Revise definitions as follows:

SECTION C202
GENERAL DEFINITIONS

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

DAYLIGHT ZONE. That portion of a building's interior floor area that is illuminated by natural light.

~~1. **Under skylights.** The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor-to-ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.~~

~~2. **Adjacent to vertical fenestration.** The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the daylight *zone* depth is assumed to extend into the space a distance of 15 feet (4572 mm) or to the nearest ceiling height opaque partition, whichever is less. The daylight *zone* width is assumed to be the width of the window plus 2 feet (610 mm) on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.~~

Reason: This proposal would replace the provisions in the code related to control of electric lights in daylight zones. It would not alter any of the envelope provisions in the code, nor would it set any minimum requirements for fenestration. The proposed changes are needed for two reasons:

1. The existing IECC code language is technically inadequate and confusing, and
2. There is a tremendous untapped potential for energy savings in buildings just by turning off electric lights in daylit spaces.

Inadequate and Confusing Language in 2012 IECC

1. The code describes all sidelight daylight zones as being 15 feet deep, regardless of whether the window is 5 feet high or 50 feet high. Lighting controls will not function properly if the daylight zone size is wrong, and the 15 foot depth requirement in the current code is actually an impediment to successful implementation of daylight responsive controls. New definitions that are based on the geometry of the building are proposed, and diagrams are provided to make the code easier to use. The proposed diagrams are modified slightly from the diagrams published in the 2012 IGCC, and if this proposal is approved these modifications should be proposed for the IGCC diagrams as well.
2. The code provides no clear guidance about the daylight zone associated with a rooftop monitor. This proposal clearly describes the daylight zone associated with rooftop monitors.
3. Small windows, windows with low-VT glass, and windows which are overshadowed by adjacent buildings are common in urban areas with older building stock. Daylight responsive controls should not be required in situations where they will be ineffective. The current code does not provide exceptions for these situations, but the proposed language does.
4. The code requires that separate control be provided for lights in each daylight zone. On facades where windows are spaced more than 4 feet apart, each window establishes a separate daylight zone, and hence a separate lighting control zone. This adds unnecessary cost and complexity to the lighting controls. The proposed daylight responsive control requirements in Section 405.2.2.3.1 resolve this issue and clarify which lights can be grouped together for control in a more sensible way.
5. The code allows step-switching in offices, laboratories, classrooms, and reading rooms, where we know this is objectionable to occupants. This proposal would require dimming in those areas, while still allowing less costly switching systems to be used in other areas.
6. The code is not specific enough about how daylight responsive controls should be required to function. An owner, developer, designer, or builder who looks for the lowest first-cost solution that meets the current code will likely end up with a lighting control system that doesn't work. The proposed Section 405.2.2.3.1 would establish minimum requirements for these systems to function properly. The code is not a design guideline, but it should prevent obvious shortcuts which subvert the intent of the code.

Additional Energy Savings from Daylight Responsive Controls

The IECC requires that daylight responsive controls only be provided in buildings following the prescriptive path which fail to meet certain fenestration requirements. This is obviously a very limited requirement, as most lighting installations are completed as part of alterations to existing buildings that do not include envelope alterations.

This proposal would require that daylight responsive controls be provided whenever more than 150 watts of lighting is installed in an area which receives effective daylight. Necessary exceptions are included for lighting in dwelling units, sleeping units, health care, etc. The 150 watt threshold was found to be cost effective by PNNL and HMG in research done to support the ASHRAE 90.1 Committee. If approved, this proposal would align the stringency of the lighting control requirements in the IECC with those of ASHRAE / ANSI / IESNA Standard 90.1 – 2013, but would still leave the IECC less stringent than California Title 24 – 2013.

Lighting in commercial buildings is responsible for 38% of electricity consumption in commercial buildings nationally. As a portion total energy use, lighting is the largest individual use of energy, accounting for one fifth (20%) of the combined energy total. This occurs despite the fact that many buildings have ample access to a free light source – daylight. A recent meta-analysis report on lighting controls in commercial buildings (Lighting Controls in Commercial Buildings, Williams, Atkins et al, 2012) estimated a 28% average lighting energy savings potential for buildings that incorporated daylighting strategies.

Guidelines published by NBI (http://patternguide.advancedbuildings.net) show that there are multiple ways to provide high quality daylight in most buildings. In addition to many energy code entities, almost every voluntary rating system has been increasing their reliance on daylighting to reduce energy consumption in commercial buildings. This proposal ensures that the IECC incorporates the energy saving priority that if sufficient daylight is available, then controls should be included to turn off the electric lights.

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

CE294_-13

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

C405.2.2.3 (NEW)-EC-BAILEY-EDELSON

CE295 – 13
C405.2.2.3, C405.2.2.3.1

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.3 Daylight zone control. Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with ~~either Section C405.2.2.3.1 or~~ Section C405.2.2.3.2. Each daylight control zone shall not exceed 2,500 square feet (232 m2). Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e., north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration. <u>The controls shall:</u>

1. <u>Control only luminaires within the daylit area.</u>
2. <u>Incorporate time-delay circuits to prevent cycling of light level changes of less than three minutes.</u>

Exception: Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

~~**C405.2.2.3.1 Manual daylighting controls.** Manual controls shall be installed in daylight zones unless automatic controls are installed in accordance with Section C405.2.2.3.2.~~

Reason: This proposal mandates the use of daylight controls in daylight zones.

Daylighting cannot save any energy unless the presence of daylight can automatically turn lights off, and the absence of light can turn them back on again. Time clocks, even when set to track daylight hours, cannot accommodate variables such as cloud cover or use of blinds, and thus are likely to be overridden.

The two additional requirements are added based on Washington State's experience with this requirement.

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

CE295-13

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

C405.2.2.3-EC-NOGLER.doc

CE296 – 13
C405.2.2.3, C405.2.2.3.1, C405.2.2.3.2

Proponent: Duane Jonlin, City of Seattle, representing City of Seattle, Department of Planning and Development (duane.jonlin@seattle.gov)

Revise as follows:

C405.2.2.3 Daylight zone control. Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with ~~either~~ Section C405.2.2.3.1 ~~or Section C405.2.2.3.2~~. Each daylight control zone shall not exceed 2,500 square feet (232 m^2). Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e., north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration. The daylight controls shall:

1. Control only luminaires within the daylit area.

2. Incorporate time-delay circuits to prevent cycling of light level changes of less than three minutes.

Exceptions:

1. Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

2. In restaurant and mercantile occupancies, light fixtures located less than 10 feet horizontally from vertical fenestration are not required to be controlled by daylight sensors where the fenestration adjoins a sidewalk or other outdoor pedestrian area.

~~**C405.2.2.3.1 Manual daylighting controls.** Manual controls shall be installed in daylight zones unless automatic controls are installed in accordance with Section C405.2.2.3.2.~~

~~**C405.2.2.3.2**~~ **C405.2.2.3.1** **Automatic daylighting controls.** Set-point and other controls for calibrating the lighting control device shall be readily accessible.

Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:

1. Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than ~~35~~20 percent of rated power at maximum light output.

2. Stepped dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control step is between 50 percent and 70 percent of design lighting power and another control step is no greater than 35 percent of design power, and the system is capable of automatically turning the system off.

Reason: Daylighting doesn't save energy unless lights are turned down or off when daylight is strong enough. Reliance on staff or occupants to manually switch off the perimeter lights when the room is bright enough is not an effective strategy.

Exception #2: Retail and restaurant occupancies need passers-by to see that the business is open. If perimeter lights turn off during bright sun conditions, the interior can appear to be dark and unoccupied from the outside.

Cost Impact: The code change proposal will not increase the cost of construction.

CE296-13

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

C405.2.2.3-EC-JONLIN.doc

CE297 – 13
C202 (NEW), C405.2.2.3.2, C405.2.2.3.3 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.2.2.3.2 Automatic daylighting controls for sidelighting. Automatic daylighting controls for sidelighting shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods: ~~Set-point and other controls for calibrating the lighting control device shall be readily accessible.~~

~~Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:~~

1. ~~Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35 percent of rated power at maximum light output.~~
2. ~~Stepped dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control step is between 50 percent and 70 percent of design lighting power and another control step is no greater than 35 percent of design power.~~

1. In any *space* where the combined input power of all general lighting completely or partially within the *primary sidelighted areas* is 150W or greater, the general lighting in the *primary sidelighted areas* shall be controlled by photocontrols.
2. In any *space* where the combined input power of all general lighting completely or partially within the *primary* and *secondary sidelighted areas* is 300W or greater the general lighting in the *primary sidelighted areas* and *secondary sidelighted areas* shall be controlled by photocontrols.

   Exceptions:

   1. *Primary sidelighted areas* where the top of the existing adjacent structures are twice as high above the windows as their distance away from the windows
   2. Sidelighted areas where the total glazing area is less than 20 square feet
   3. Retail spaces

3. The control system shall have the following characteristics:

   1. The calibration adjustments shall be readily accessible;
   2. At a minimum, general lighting in the *secondary sidelighted area* shall be controlled independently of the general lighting in the *primary sidelighted area*;
   3. The photocontrol shall reduce electric lighting in response to available daylight using continuous dimming or with at least one control point between 50 percent and 70 percent of design lighting power, a second control point between 20 percent and 40 percent of design lighting power, and a third control point that turns off all the controlled lighting.

C405.2.2.3.3 Automatic Daylighting Controls for Toplighting. In any space where the combined input power for all general lighting completely or partially within *daylight areas under skylights* and *daylight areas under roof monitors* is 150W or greater, general lighting in the daylight area shall be controlled by photocontrols having the following characteristics:

1. The calibration adjustments shall be readily accessible;

2. The photocontrol shall reduce electric lighting in response to available daylight using continuous dimming or with at least one control point that is between 50 percent and 70 percent of design lighting power, a second control point between 20 percent and 40 percent of design lighting power, and a third control point that turns off all the controlled lighting; and
3. General lighting in overlapping toplighted and sidelighted daylight areas shall be controlled together with general lighting in the *daylight area under skylights* or *daylight areas under roof monitors*.

Exceptions:

1. *Daylight areas under skylights* where it is documented that existing adjacent structures or natural objects block direct beam sunlight for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.
2. Daylight areas where the skylight visible transmittance (VT) is less than 0.4.
3. Spaces within buildings in climate zone 8 where the input power of the general lighting within daylight areas is less than 200W.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

DAYLIGHT AREA UNDER SKYLIGHTS. The *daylight area under skylights* is the combined daylight area under each skylight within a *space.* The daylight area under each skylight is bounded by the opening beneath the skylight, plus horizontally in each direction, the smaller of:

1. 70 percent of the ceiling height (0.7 × CH), or
2. The distance to the front face of any opaque vertical obstruction where any part of the obstruction is farther away than 70 percent of the distance between the top of the obstruction and the ceiling (0.7 × [CH– OH]), where CH = the height of the ceiling at the lowest edge of the skylight, and OH = the height to the top of the obstruction.

DAYLIGHT AREA UNDER ROOF MONITORS. The daylight area under roof monitors is the combined daylight area under each roof monitor within each space. The daylight area under each roof monitor is the product of

1. The width of the vertical fenestration above the ceiling level plus on each side, the smallest of the following:

1.1 2 feet;
1.2. The distance to any 60 in or higher vertical obstruction or;
1.3. The distance to the edge of any *primary sidelighted area*.

and

2. The smaller of the following horizontal distances inward from the bottom edge of the vertical fenestration:

2.1 The monitor sill height, MSH, (the vertical distance from the floor to the bottom edge of the monitor glazing), or
2.2 The distance to the front face of any opaque vertical obstruction where any part of the obstruction is farther away than the difference between the height of the obstruction and the monitor sill height (MSH-OH).

PRIMARY SIDELIGHTED AREA. The total primary sidelighted area is the combined primary sidelighted area within each space. Each primary sidelighted area is directly adjacent to vertical fenestration below the ceiling..

1. The primary sidelighted area width is the width of the vertical fenestration plus, on each side, the smaller of:

   1.1 One half of the vertical fenestration head height (head height is the distance from the floor to the top of the glazing), or
   1.2 The distance to any 5 feet or higher opaque vertical obstruction.

2. The primary sidelighted area depth is the horizontal distance perpendicular to the vertical fenestration which is the smaller of:

   2.1. One vertical fenestration head height, or
   2.2. The distance to any 5 feet or higher opaque vertical obstruction.

SECONDARY SIDELIGHTED AREA. The total secondary sidelighted area is the combined secondary sidelighted area within a space. Each secondary sidelighted area is directly adjacent to a *primary sidelighted area*.

1. The secondary sidelighted area width is the width of the vertical fenestration plus, on each side, the smaller of:
   1.1 One half of the vertical fenestration head height, or
   1.2 The distance to any 5 feet or higher opaque vertical obstruction.
2. The secondary sidelighted area depth is the horizontal distance perpendicular to the vertical fenestration which begins at the edge of the *primary sidelighted area* depth and ends at the smaller of:
   2.1. One vertical fenestration head height, or
   2.2. The distance to any 5 feet or higher opaque vertical obstruction.

   Where the adjacent *primary sidelighted area* ends at a 5 feet or higher opaque vertical obstruction, there is no secondary sidelighted area beyond such obstruction.

Reason: This proposal adds daylighting control requirements that are consistent with the published requirements in addendum ay to ANSI/ASHRAE/IES Standard 90.1. Specifically, the revision changes the thresholds for applying daylighting controls to a wattage controlled basis that allows straightforward application and easy enforcement of the requirements. The requirement applies to more spaces in a building for additional energy savings, simplifies the delineation of daylight zones, and clarifies area calculations. These revisions are based on an extensive cost effectiveness analysis.

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

CE297-13

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

C405.2.2.3.2-EC-FERGUSON.doc

CE298 – 13
C405.2.2.3.2

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.3.2 Automatic daylighting controls. Set-point and other controls for calibrating the lighting control device shall be readily accessible.

Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:

1. Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than ~~35~~ 20 percent of rated power at maximum light output.
2. Stepped dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control step is between 50 percent and 70 percent of design lighting power and another control step is no greater than 35 percent of design power, and the system is capable of automatically turning the system off.

Reason: Ballasts capable of dimming to less than 20% of rated power are now commonly available, and such ballasts provide a much more subtle shift from the lowest setting to completely off. There is no reason for fixtures to remain on, even at low power, when daylight is filling the room. Allowing a full-off setting will mean that many fixtures will not turn on at all during summer hours, saving both lighting energy and cooling energy.

Cost Impact: The code change proposal will not increase the cost of construction.

CE298-13

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

C405.2.2.3.2-EC-NOGLER.doc

CE299 – 13
C405.2.3

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.2.3 Specific application controls. Specific application controls shall be provided for the following:

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space
2. Lighting in cases used for display case purposes shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. Hotel and motel sleeping units and guest suites shall have a master control device ~~at the main room entry that controls all permanently installed luminaires and switched receptacles~~ <u>that is capable of switching off all installed luminaires and switched receptacles within 20 minutes after all occupants leave the room.</u>

    <u>**Exception**: Lighting and switched receptacles controlled by captive key systems.</u>

4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible.
5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

Reason: For consistency with ASHRAE/IES 90.1. These revisions introduce automatic lighting control to guestroom type spaces for additional energy savings and allow captive key systems that provide similar savings control to also comply.

Cost Impact: The code change proposal will increase the cost of construction when lighting controls are required in parking garages.

CE299-13

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

C405.2.3-EC-FERGUSON.doc

CE300 – 13
C405.2.3

Proponent: Andrei Moldoveanu, The National Electrical Manufacturers Association (NEMA) (and_moldoveanu@nema.org), David Collins, The Preview Group, representing American Institute of Architects (AIA)

Revise as follows:

C405.2.3 Specific application controls. Specific application controls shall be provided for the following:

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
2. Lighting in cases used for display case purposes shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. ~~Hotel and motel~~ Lighting and switched receptacles in sleeping units ~~and guest suites~~ shall ~~have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles~~ be automatically controlled such that the power to the lighting and switched receptacles will be turned off within 30 minutes after all occupants leave the room.

   Exception: Lighting and switched receptacles controlled by a captive key system.

4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible.
5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

Reason: Adoption of this proposal will save energy.

Cost Impact: The code change proposal will not increase the cost of constructinon.

CE300-13

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

C405.2.3-EC-MOLDOVEANU.doc

CE301 – 13
C405.2.3

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.3 Specific application controls. Specific application controls shall be provided for the following:

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
2. Lighting in cases used for display case purposes shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. Hotel and motel sleeping units and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible.
5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
7. <u>Luminaires serving the *exit access* and providing the means of egress illumination required by Section 1006.1 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination, shall be controlled by a combination of listed emergency relays and occupancy sensors, or a signal from another building control system, that automatically turns off the lighting when the areas served by that illumination are unoccupied.</u>

   <u>**Exception**. Means of egress illumination serving the *exit access* that does not exceed 0.05 watts per square foot of building area is exempt from this requirement.</u>

Reason: This provision requires the egress lighting in the *exit access* (only) to be controlled either by occupancy sensors or the building automatic time clock system, so that those lights will turn off along with all of the other general area lighting when the floor is unoccupied. These lights will still turn on with emergency power when normal power is lost.

The egress lighting governed by this rule typically consists of fixtures that do double duty as normal and emergency lighting. An exception is provided to allow a small number of fixtures to remain on 24/7 where needed to prevent total blackout.

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

CE301-13

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

C405.2.3-EC-NOGLER.doc

CE302 – 13
C405.2.3

Proponent: Duane Jonlin, City of Seattle, representing City of Seattle Department of Planning and Development (duane.jonlin@seattle.gov)

Revise as follows:

C405.2.3 Specific application controls. Specific application controls shall be provided for the following:

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
2. Lighting in cases used for display case purposes shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. Hotel and motel sleeping units and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible.
5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
7. <u>Each stairway shall have one or more control devices to automatically reduce lighting power by not less than 50 percent when no occupants have been detected in the stairway for a period not exceeding 30 minutes, and restore lighting to full power when occupants enter the stairway. All portions of stairways shall remain illuminated to at least 1 footcandle (11 lux) at the walking surface when the lighting power is reduced.</u>
8. <u>Lighting in parking garages shall have one or more control devices to automatically reduce lighting power in any one controlled zone by not less than 50 percent when no occupants have been detected in that zone for a period not exceeding 30 minutes, and restore lighting to full power when occupants enter or approach the zone. Each lighting zone controlled by occupancy sensors shall be no larger than 7,200 square feet. Pedestrian occupancy sensors controlling any lighting zone are permitted to be configured to detect pedestrians no more than 30 feet outside of that zone. Vehicle occupancy sensors controlling any lighting zone are permitted to be configured to detect vehicles no more than 60 feet outside of that zone.</u>

Reason: This provision allows stairs enclosures and parking garages lighting energy use to be reduced by half when unoccupied, then come back to full brightness when occupants enter those spaces. It provides a balance between safety, security and energy use. These measures are currently in force in Seattle.

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

CE302-13

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

C405.2.3-EC-JONLIN.doc

CE303 – 13
C405.2.4

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Delete and substitute as follows:

~~**C405.2.4 Exterior lighting controls.** Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of a photosensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.~~

C405.2.4 Exterior lighting controls. Exterior lighting shall be controlled by either an astronomical time switch or a photo sensor and a time switch. Time switches shall be capable of retaining programming and the time setting for at least 10 hours without power.

> **Exception:** Lighting designed for dusk to dawn operation shall be permitted to have a photo sensor without a time switch.

Reason: This proposal simplifies the provisions covering exterior lighting controls in the code, to foster the ability to implement and verify compliance with the code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE303-13

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

C405.2.4 (NEW)-EC-WILLIAMS.doc

CE304 – 13
C405.2.4

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Delete and substitute as follows:

~~**C405.2.4 Exterior lighting controls.** Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of a photosensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours~~

C405.2.4 Exterior lighting controls. Lighting for exterior applications other than emergency lighting that is intended to be automatically off during building operation, lighting specifically required to meet health and life safety requirements or decorative gas lighting systems shall:

1. Be provided with a control that automatically turns off the lighting as a function of available daylight.
2. Where lighting the building façade or landscape the lighting shall have controls that automatically shut off the lighting as a function of dawn/dusk and a set opening and closing time.
3. Where not covered in Item 2 the lighting shall have controls configured to automatically reduce the connected lighting power by at least 30 percent from no later than 12 midnight to 6 a.m. or from one hour after business closing to one hour before business opening or during any period when no activity has been detected for a time of no longer than 15 minutes.

All time switches shall be able to retain programming and the time setting during loss of power for a period of at least ten hours.

Exception: Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

Reason: For consistency with ASHRAE/IES 90.1-2010. Section 9.4.1.7 of that document contains provisions for exterior lighting controls that differ from those in Section C405.2.4 of the IECC Commercial Provisions. As that standard is an alternative path to compliance with the IECC and there is a desire to maintain equivalency of the IECC with 90.1 this change is needed.

Cost Impact: The code change proposal will not increase the cost of construction.

CE304-13

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

C405.2.4-EC-FERGUSON.doc

CE305 – 13
C405.2.5 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C405.2.5 Area controls. The maximum lighting power controlled from a single switch or automatic control shall not exceed that which is provided by a 20 ampere circuit loaded to not more than 80 percent. Where a master control is provided, individual switches shall retain the capability to function independently. Circuit breakers shall not be used as the sole means of switching.

> **Exception:** Areas less than 5 percent of the floor area of a story for stories over 100,000 square feet in area need not comply with this section.

Reason: This code provision limits the area controlled by a single switch or a single occupancy sensor. At typical office lighting levels, the maximum area would be about 1,900 SF. A lone office worker in on a Saturday shouldn't have to turn on lights for the entire floor.

The exception allows factories and warehouses to be subdivided into larger lighting areas.

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

CE305-13

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

C405.2.5 (NEW)-EC-NOGLER.doc

CE306 – 13
C405.2.5 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Add new text as follows:

C405.2.5 Lighting in refrigerated display cases and walk-in coolers. Lighting in refrigerated display cases, and lights on glass doors installed on walk-in coolers and freezers shall be controlled by one of the following:

1. Automatic time switch controls to turn off lights during non-business hours.
2. Motion sensor controls on each case that reduce display case lighting power by not less than 50 percent within 30 minutes after the area near the case is vacated

Reason: The proposal reduces energy waste by reducing the power level of display lights in refrigerated display cases and glass doors in walk-in coolers during non-business hours and when the nearby area is not in use. Providing automatic controls ensures that lights not in use are automatically reduced in power by at least 50%. Reducing unnecessary lighting of refrigerated areas reduces energy used both for lighting and for the additional cooling load from added heat source. The language for the proposal is adapted from California Title 24-2013.

Cost Impact: The code change proposal will increase the cost of construction but will reduce the overall operating cost of the display case offsetting the first cost of the control.

CE306-13

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

C405.2.5 (NEW)-EC-MAKELA.doc

CE307 – 13
C405.2.5 (New)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C405.2.5 Lighting controls in parking garages. Parking garages shall comply with the provisions of Section C405.2.1 and C405.2.2. Lighting shall be provided with controls which are capable of automatically reducing the power supplied to each luminaire by not less than 30 percent after 30 minutes of inactivity in an area not greater than 36,000 square feet. Lighting for covered vehicle entrances to and exits from the garage shall be separately controlled and comply with of Section C405.2.4.

Luminaires within 20 feet of any perimeter wall that has a net opening to wall area ratio of at least 40 open and no exterior obstructions within 20 feet of the wall shall be provided with controls that will automatically adjust the lighting in response to available daylight.

Exceptions: Controls are not required for the following:
1. High-intensity discharge lamps not greater than 150 watts
2. induction lamps
3. Luminaires that illuminate daylight transitions zones without parking
4. Luminaires that illuminate ramps without parking.
5. Luminaires proximate to exterior walls.

Reason: For consistency with ASHRAE/IES 90.1-2010. Section 9.4.1.3 of that document contains provisions for lighting controls in parking garages and no such provisions exist in the IECC Commercial Provisions. As that standard is an alternative path to compliance with the IECC and there is a desire to maintain equivalency of the IECC with 90.1 this change is needed.

Cost Impact: The code change proposal will increase the cost of construction when lighting controls are required in parking garages.

CE307-13

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

C405.2.5 (NEW)-EC-FERGUSON.doc

CE308 – 13
C405.3

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Delete without substitution as follows:

~~**C405.3 Tandem wiring (Mandatory).** The following luminaires located within the same area shall be tandem wired:~~

1. ~~Fluorescent luminaires equipped with one, three or odd-numbered lamp configurations, that are recess- mounted within 10 feet (3048 mm) center-to-center of each other.~~
2. ~~Fluorescent luminaires equipped with one, three or any odd-numbered lamp configuration that are pendant- or surface-mounted within 1 foot (305 mm) edge-to-edge of each other.~~

~~**Exceptions:**~~

1. ~~Where electronic high-frequency ballasts are used.~~
2. ~~Luminaires on emergency circuits.~~
3. ~~Luminaires with no available pair in the same area.~~

Reason: Simplify the code by removing an obsolete provision. This provision refers to obsolete magnetic ballast technology and no longer serves any purpose. Electronic ballasts are now used for all fluorescent luminaires, and since luminaires with electronic ballasts are exempt, then this provision would never apply and is pointless. It was removed from the 2010 version of Standard 90.1 for these reasons.

Cost Impact: The code change proposal will not increase the cost of construction.

CE308-13

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

C405.3-EC-HEINMILLER.doc

CE309 – 13
C405.5.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power ~~(watts)~~ shall be ~~the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4~~ determined in accordance with Equation 4-6.

TCLP = [SL + LV + LTPB + Other] **(Equation 4-6)**

where:

TCLP = total connected lighting power (watts)
SL = labeled wattage of luminaires for screw in lamps
LV = wattage of the transformer supplying low-voltage lighting
LTPB = wattage of line-voltage lighting tracks and plug-in busways as the specified wattage of the luminaires but at least 30 W/lin. ft. (100 W/lin m), or the wattage limit of the system's circuit breaker, or the wattage limit of other permanent current limiting devices on the system
Other = the wattage of all other luminaires and lighting sources not covered above and associated with interior lighting verified by data supplied by the manufacturer or other *approved* sources.

Exceptions:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.
   - 1.1. Professional sports arena playing field lighting.
   - 1.2. *Sleeping unit* lighting in hotels, motels, boarding houses or similar buildings.
   - 1.3. Emergency lighting automatically off during normal building operation.
   - 1.4. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired visual impairment and other medical and age-related issues.
   - 1.5. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
   - 1.6. Casino gaming areas.
2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:
   - 2.1. Task lighting for medical and dental purposes.
   - 2.2. Display lighting for exhibits in galleries, museums and monuments.
3. Lighting for theatrical purposes, including performance, stage, film production and video production.
4. Lighting for photographic processes.
5. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
6. Task lighting for plant growth or maintenance.
7. Advertising signage or directional signage.
8. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
9. Lighting equipment that is for sale.
10. Lighting demonstration equipment in lighting education facilities.
11. Lighting *approved* because of safety or emergency considerations, inclusive of exit lights.
12. Lighting integral to both open and glass-enclosed refrigerator and freezer cases.

13. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

Reason: The provisions in Section C405.5.1 deal with the determination of a value for the actual connected interior lighting power in a building that is more appropriately addressed as an equation. This proposal simplifies the provisions associated with connected interior lighting power to present as an equation what is now text that guides how the connected lighting power is calculated. The objective of this proposal is to simplify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal does not increase the cost of construction.

CE309-13

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

C405.5.1 #1-EC-WILLIAMS.doc

CE310 – 13

C405.5.1, C405.5.3 (NEW), Table C405.5.2(1), Table C405.5.2(2)

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4.

Exceptions:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.
   1.1. Professional sports arena playing field lighting.
   1.2. *Sleeping unit* lighting in hotels, motels, boarding houses or similar buildings, provided that the lighting complies with Section R404.1.
   1.3. Emergency lighting automatically off during normal building operation.
   1.4. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired visual impairment and other medical and age-related issues.
   1.5. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
   1.6. Casino gaming areas.
   1.7. Mirror lighting in dressing rooms.

(Portions of text not shown remains unchanged)

C405.5.3 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

1. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 1.0 W/ft^2 of such spaces.

TABLE C405.5.2(1)
INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (w/ft2)
Automotive facility	~~0.9~~ 0.80
Convention center	~~1.2~~ 1.01
Courthouse	~~1.2~~ 1.01
Dining: bar lounge/leisure	~~1.3~~ 1.01
Dining: cafeteria/fast food	~~1.4~~ 0.9

BUILDING AREA TYPE	LPD (w/ft2)
Dining: family	~~1.6~~ 0.95
Dormitory	~~1.0~~ 0.57
Exercise center	~~1.0~~ 0.84
Fire station	~~0.8~~ 0.67
Gymnasium	~~1.1~~ 0.94
Health care clinic	~~1.0~~ 0.90
Hospital	~~1.2~~ 1.05
Hotel/Motel	~~1.0~~ 0.87
Library	~~1.3~~ 1.19
Manufacturing facility	~~1.3~~ 1.17
~~Motel~~	~~1.0~~
Motion picture theater	~~1.2~~ 0.76
Multifamily	~~0.7~~ 0.51
Museum	~~1.1~~ 1.02
Office	~~0.9~~ 0.82
Parking garage	~~0.3~~ 0.21
Penitentiary	~~1.0~~ 0.81
Performing arts theater	~~1.6~~ 1.39
Police station	~~1.0~~ 0.87
Post office	~~1.1~~ 0.87
Religious building	~~1.3~~ 1.0
Retail	~~1.4~~ 1.26
School/University	~~1.2~~ 0.87
Sports arena	~~1.1~~ 0.91
Town hall	~~1.1~~ 0.89
Transportation	~~1.0~~ 0.70
Warehouse	~~0.6~~ 0.66

BUILDING AREA TYPE	LPD (w/ft2)
Workshop	~~1.4~~ 1.19

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES:
SPACE-BY-SPACE METHOD

COMMON SPACE-BY-SPACE TYPES	LPD (w/ft2)
Atrium -~~First~~ that is < 40 feet in height	0.03 per ft. in total height ~~ht.~~
Atrium - ~~Above~~ that is > 40 feet in height	0.40 + 0.02 per ft. in total height ~~ht.~~
Audience/seating area - permanent For auditorium For performing arts theater For motion picture theater	 ~~0.9~~ 0.63 ~~2.6~~ 2.43 ~~1.2~~ 1.14
Classroom/lecture/training	~~1.30~~ 1.24
Conference/meeting/multipurpose	~~1.2~~ 1.23
Copy/Print room	0.72
Corridor/transition	~~0.7~~ 0.66
Computer Room	1.71
Dining area Bar/lounge/leisure dining Family dining area Cafeteria/Fast Food Dining	 ~~1.40~~ 1.07 ~~1.40~~ 0.89 0.65
Dressing/fitting room in performing arts theater	~~1.1~~ 0.61
Electrical/mechanical	~~1.10~~ 0.42
Emergency Vehicle Garage	0.56
Food preparation	~~1.20~~ 1.21
Laboratory for classrooms	~~1.3~~ 1.43
Laboratory for medical/industrial/research	~~1.8~~ 1.81
Laundry/Washing area	0.60
Loading Dock (interior)	~~0.47~~
Lobby	~~1.10~~ 0.90
Lobby for performing arts theater	~~3.3~~ 2.00
Lobby for motion picture theater	~~1.0~~ 0.59
Lobby - elevator	0.64
Lobby for Hotel	1.06
Locker room	~~0.80~~ 0.75
Lounge/~~ recreation~~ Breakroom	~~0.8~~ 0.73
Office- enclosed	~~1.1~~ 1.11

Office- open plan	~~1.0~~ 0.98
Pharmacy Area	1.68
Restroom	~~1.0~~ 0.98
Sales area	~~1.6[a]~~ 1.44
Stairway	~~0.70~~ 0.69
Storage	~~0.8~~ 0.63
Vehicular Maintenance Area	0.67
Workshop	~~1.60~~ 1.59
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
Courthouse/police station/penitentiary	
Courtroom	~~1.90~~ 1.72
Confinement cells	~~1.1~~ 0.81
~~Judge chambers~~	~~1.3~~
Penitentiary audience seating	~~0.5~~ 0.28
Penitentiary classroom	~~1.3~~ 1.34
Penitentiary dining	~~1.1~~ 0.96
~~Automotive- service/repair~~	~~0.70~~
Bank/office- banking activity area	~~1.5~~ 1.01
Dormitory ~~living quarters~~ bedrooms	~~1.10~~ 0.38
Gymnasium/fitness center	
~~Fitness~~ Exercise area	~~0.9~~ 0.72
Gymnasium audience/seating	~~0.40~~ 0.65
Playing area	~~1.40~~ 1.2
Healthcare clinic/hospital	
Corridors/transition	~~1.00~~ 0.99
Exam/treatment	~~1.7~~ 1.66
~~Emergency~~	~~2.70~~
~~Public and staff lounge~~	~~0.80~~
Medical supplies	~~1.40~~ 0.74
Nursery	~~0.9~~ 0.88
Nurse station	~~1.00~~ 0.71
Physical therapy	~~0.90~~ 0.91
Patient room	~~0.70~~ 0.62
~~Pharmacy~~	~~1.20~~
Radiology/imaging	~~1.3~~ 1.51
Operating room	~~2.20~~ 2.48
Recovery	~~1.2~~ 1.15
Lounge/Breakroom	~~0.8~~ 0.92
~~Laundry - washing~~	~~0.60~~
~~Hotel~~	
~~Dining area~~	~~1.30~~
~~Guest rooms~~	~~1.10~~
~~Hotel lobby~~	~~2.10~~
~~Highway lodging dining~~	~~1.20~~
~~Highway lodging guest rooms~~	~~1.10~~

Library	
Stacks	~~1.70~~ 1.71
~~Card file and cataloguing~~	~~1.10~~
Reading area	~~1.20~~ 1.06
Manufacturing	
Corridors/transition	~~0.40~~ 0.41
Detailed manufacturing	~~1.3~~ 1.29
Equipment room	~~1.0~~ 0.74
Extra high bay (>50-foot floor-ceiling height)	
High bay (25-- 50-foot floor-ceiling height)	~~1.1~~ 1.05
Low bay(< 25-foot floor-ceiling height)	
	~~1.20~~ 1.23
	~~1.2~~ 1.19
Museum	
General exhibition	~~1.00~~ 1.05
Restoration	~~1.70~~ 1.02
Parking garage - garage areas	~~0.2~~ 0.19
Convention center	
Exhibit space	~~1.50~~ 1.45
Audience/seating area	~~0.90~~ 0.82
~~Fire stations~~	
~~Engine room~~	~~0.80~~
Fire Station Sleeping Quarters	~~0.30~~ 0.22
Post office Sorting area	~~0.9~~ 0.94
Religious building	
Fellowship hall	~~0.60~~ 0.64
Audience seating	~~2.40~~ 1.53
Worship pulpit/choir	~~2.40~~ 1.53
Retail	
Dressing/fitting area	~~0.9~~ 0.71
Mall concourse	~~1.6~~ 1.10
Sales area	~~1.6~~ 1.59
Sports arena	
Audience seating	~~0.4~~ 0.43
~~Court sports~~ Playing area - Class 4	~~0.7~~ 1.20
~~Court sports~~ Playing area - Class 3	~~1.2~~ 1.80
~~Court sports~~ Playing area - Class 2	~~1.9~~ 2.40
~~Court sports~~ Playing area - Class 1	~~3.0~~ 3.68
~~Ring sports area~~	~~2.7~~
Transportation	
Air/train/bus baggage area	~~1.00~~ 0.53
Airport concourse	~~0.60~~ 0.36
Terminal - ticket counter	~~1.50~~ 0.80
Warehouse	
~~Fine material storage~~ small hand-carried items	~~1.40~~ 0.95
Medium/bulky material, palletized items	~~0.60~~ 0.58

(Portions of Table not shown remain unchanged)

Reason: The purpose of this change is to adjust the lighting power density allowances to the best available values. “Best” means values and methodology for determining allowances that will lead to high energy-efficiency while still allowing high-quality lighting and sufficient light levels. We believe that the best source for these values are the models maintained by Pacific Northwest National Lab (PNNL) for the DOE in support of ASHRAE/IES Standard 90.1 development. Recently the models were updated to account for some changes in recommended light levels in the new Lighting Handbook, 10th Edition from the Illuminating Engineering Society (IES). Additionally several new space types were added and some space types renamed or removed for clarity. Also, the Building Area Method values were based on a larger data set with 56% additional representative buildings.

Additional explanation of proposed changes by section:

Exception 1.2 to C405.5.1, (Sleeping Unit exception to lighting power limits)

Sleeping Units should be subject to the same requirements as Dwelling Units and residential buildings covered by Chapter 4 [RE].

Add exception for Mirror Lighting in Dressing Rooms.

Because this exception is in Standard 90.1, we assume that the LPD for Dressing/Fitting Room space types was developed with mirror lighting excluded. Without this exception the LPD limit for Dressing Rooms would be too low.

Add “Additional Interior Lighting Power” section.

This provision is an integral part of the space-by-space method. IECC-2012 already includes the additional power for retail as a footnote to the LPD table. The proposal adds the special allowance for decorative lighting and lighting for art and exhibits. IECC-2012 is missing this allowance, which is why some of the LPD values in IECC-2012 for some space types are higher than 90.1-2010. This allowance is a “use it or lose it” addition that can only be used for certain types of lighting. This provision gives the designer more flexibility but should not result in significant increase or decrease in stringency. The proposed new space-by-space LPD values were developed with the understanding that this additional allowance is available to the designer. The LPDs would not be valid for many space types without this additional allowance.

Revise Building Area Method LPDs (Table C405.5.2(1))

As mentioned above, these proposed values are from current PNNL models. These values were published in the public review draft of Addendum “co” to ASHRAE/IES Standard 90.1.

Revise Space-by-space Method LPDs (Table C405.5.2(2))

As mentioned above, these proposed values and space types are from current PNNL models. These values were published in the public review draft of Addendum “bh” to ASHRAE/IES Standard 90.1. The formatting and the ordering of space types that is in the IECC-2012 table were changed as little as possible. In order to accommodate the new space types, and the renaming or removal of a few space types, some rearrangement was necessary.

Cost Impact: The code change proposal will not increase the cost of construction.

CE310-13

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

C405.5.1 #1-EC-HEINMILLER.doc

CE311 – 13
Table C405.5.2(1), Table C405.5.2(2)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

**TABLE C405.5.2(1)
INTERIOR LIGHTING POWER ALLOWANCES:
BUILDING AREA METHOD**

BUILDING AREA TYPE[a]	LPD (w/ft^2)
Automotive facility	~~0.9~~ 0.82
Convention center	~~1.2~~1.08
Courthouse	~~1.2~~1.05
Dining: bar lounge/leisure	~~1.3~~0.99
Dining: cafeteria/fast food	~~1.4~~0.90
Dining: family	~~1.6~~0.89
Dormitory	~~1.0~~0.61
Exercise center	~~1.0~~0.88
Fire station	~~0.8~~0.71
Gymnasium	~~1.1~~1.00
Health care clinic	~~1.0~~0.87
Hospital	~~1.2~~1.21
Hotel	~~1.0~~1.00
Library	~~1.3~~1.18
Manufacturing facility	~~1.3~~1.11
Motel	~~1.0~~0.88
Motion picture theater	~~1.2~~0.83
Multifamily	~~0.7~~0.60
Museum	~~1.1~~1.06
Office	0.9
Parking garage	~~0.3~~0.25
~~Penetentiary~~ Penitentiary	~~1.0~~0.97
Performing arts theater	~~1.6~~1.39
Police station	~~1.0~~0.96
Post office	~~1.1~~0.87
Religious building	~~1.3~~1.05
Retail	~~1.4~~1.40
School/university	~~1.2~~0.99

BUILDING AREA TYPE[a]	LPD (w/ft^2)
Sports arena	~~1.1~~0.78
Town hall	~~1.1~~0.92
Transportation	~~1.0~~0.77
Warehouse	~~0.6~~0.66
Workshop	~~1.4~~1.20

a In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.

~~**TABLE C405.5.2(2)**~~
~~**INTERIOR LIGHTING POWER ALLOWANCES:**~~
~~**SPACE-BY-SPACE METHOD**~~

~~**COMMON SPACE-BY-SPACE TYPES**~~	~~**LPD (w/ft^2)**~~
~~Atrium – First 40 feet in height~~	~~0.03 per ft. ht.~~
~~Atrium – Above 40 feet in height~~	~~0.02 per ft. ht.~~
~~Audience/seating area – permanent~~ ~~For auditorium~~ ~~For performing arts theater~~ ~~For motion picture theater~~ ~~Classroom/lecture/training~~ ~~Conference/meeting/multipurpose~~ ~~Corridor/transition~~	 ~~0.9~~ ~~2.6~~ ~~1.2~~ ~~1.30~~ ~~1.2~~ ~~0.7~~
~~Dining area~~ ~~Bar/lounge/leisure dining~~ ~~Family dining area~~	 ~~1.40~~ ~~1.40~~
~~Dressing/fitting room performing arts theater~~	~~1.1~~
~~Electrical/mechanical~~	~~1.10~~
~~Food preparation~~	~~1.20~~
~~Laboratory for classrooms~~	~~1.3~~
~~Laboratory for medical/industrial/research~~	~~1.8~~
~~Lobby~~	~~1.10~~
~~Lobby for performing arts theater~~	~~3.3~~
~~Lobby for motion picture theater~~	~~1.0~~
~~Locker room~~	~~0.80~~
~~Lounge recreation~~	~~0.8~~
~~Office – enclosed~~	~~1.1~~
~~Office – open plan~~	~~1.0~~
~~Restroom~~	~~1.0~~
~~Sales area~~	~~1.6~~[a]

~~COMMON SPACE-BY-SPACE TYPES~~	~~LPD (w/ft²)~~
~~Stairway~~	~~0.70~~
~~Storage~~	~~0.8~~
~~Workshop~~	~~1.60~~
~~Courthouse/police station/penetentiary~~	
~~— Courtroom~~	~~1.90~~
~~— Confinement cells~~	~~1.1~~
~~— Judge chambers~~	~~1.30~~
~~— Penitentiary audience seating~~	~~0.5~~
~~— Penitentiary classroom~~	~~1.3~~
~~— Penitentiary dining~~	~~1.1~~
~~BUILDING SPECIFIC SPACE-BY-SPACE TYPES~~	
~~Automotive – service/repair~~	~~0.70~~
~~Bank/office – banking activity area~~	~~1.5~~
~~Dormitory living quarters~~	~~1.10~~
~~Gymnasium/fitness center~~	
~~— Fitness area~~	~~0.9~~
~~— Gymnasium audience/seating~~	~~0.40~~
~~— Playing area~~	~~1.40~~
~~Healthcare clinic/hospital~~	
~~— Corridors/transition~~	~~1.00~~
~~— Exam/treatment~~	~~1.70~~
~~— Emergency~~	~~2.70~~
~~— Public and staff lounge~~	~~0.80~~
~~— Medical supplies~~	~~1.40~~
~~— Nursery~~	~~0.9~~
~~— Nurse station~~	~~1.00~~
~~— Physical therapy~~	~~0.90~~
~~— Patient room~~	~~0.70~~
~~— Pharmacy~~	~~1.20~~
~~— Radiology/imaging~~	~~1.3~~
~~— Operating room~~	~~2.20~~
~~— Recovery~~	~~1.2~~
~~— Lounge/recreation~~	~~0.8~~
~~— Laundry – washing~~	~~0.60~~
~~Hotel~~	
~~— Dining area~~	~~1.30~~
~~— Guest rooms~~	~~1.10~~
~~— Hotel lobby~~	~~2.10~~
~~— Highway lodging dining~~	~~1.20~~
~~— Highway lodging guest rooms~~	~~1.10~~
~~Library~~	
~~— Stacks~~	~~1.70~~
~~— Card file and cataloguing~~	~~1.10~~
~~— Reading area~~	~~1.20~~

~~COMMON SPACE-BY-SPACE TYPES~~	~~LPD (w/ft^2)~~
~~Manufacturing~~	
~~Corridors/transition~~	~~0.40~~
~~Detailed manufacturing~~	~~1.3~~
~~Equipment room~~	~~1.0~~
~~Extra high bay (> 50-foot floor-ceiling height)~~	~~1.1~~
~~High bay (25- – 50-foot floor-ceiling height)~~	~~1.20~~
~~Low bay (< 25-foot floor-ceiling height)~~	~~1.2~~
~~Museum~~	
~~General exhibition~~	~~1.00~~
~~Restoration~~	~~1.70~~
~~Parking garage – garage areas~~	~~0.2~~
~~Convention center~~	
~~Exhibit space~~	~~1.50~~
~~Audience/seating area~~	~~0.90~~
~~Fire stations~~	
~~Engine room~~	~~0.80~~
~~Sleeping quarters~~	~~0.30~~
~~Post office~~ ~~Sorting area~~	~~0.9~~
~~Religious building~~	
~~Fellowship hall~~	~~0.60~~
~~Audience seating~~	~~2.40~~
~~Worship pulpit/choir~~	~~2.40~~
~~Retail~~	
~~Dressing/fitting area~~	~~0.9~~
~~Mall concourse~~	~~1.6~~
~~Sales area~~	~~1.6~~[a]
~~Sports arena~~	
~~Audience seating~~	~~0.4~~
~~Court sports area – Class 4~~	~~0.7~~
~~Court sports area – Class 3~~	~~1.2~~
~~Court sports area – Class 2~~	~~1.9~~
~~Court sports area – Class 1~~	~~3.0~~
~~Ring sports area~~	~~2.7~~
~~Transportation~~	
~~Air/train/bus baggage area~~	~~1.00~~
~~Airport concourse~~	~~0.60~~
~~Terminal – ticket counter~~	~~1.50~~
~~Warehouse~~	
~~Fine material storage~~	~~1.40~~
~~Medium/bulky material~~	~~0.60~~

~~For SI: 1 foot = 304.8 mm, 1 watt per square foot = 11 W/m^2.~~

~~a. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.~~

~~Calculate the additional lighting power as follows:~~

~~Additional Interior Lighting Power Allowance = 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6 W/ft^2) + (Retail Area 3 × 1.4 W/ft^2) + (Retail Area 4 × 2.5 W/ft^2).~~

~~where:~~

~~Retail Area 1 =The floor area for all products not listed in Retail Area 2, 3 or 4.~~

~~Retail Area 2 =The floor area used for the sale of vehicles, sporting goods and small electronics.~~
~~Retail Area 3 =The floor area used for the sale of furniture, clothing, cosmetics and artwork.~~
~~Retail Area 4 =The floor area used for the sale of jewelry, crystal and china.~~

~~**Exception:** Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.~~

Table C405.5.2(2)
Lighting Power Density Allowances Using the Space-by-Space Method

-	-	-
Common Space Types[1]	**LPD watts/sq.ft**	**RCR Threshold**
Audience Seating Area		
... in an auditorium	0.63	6
... in a convention center	0.82	4
... in a gymnasium	0.65	6
... in a motion picture theater	1.14	4
... in a penitentiary	0.28	4
... in a performing arts theater	2.43	8
... in a religious building	1.53	4
... in a sports arena	0.43	4
... otherwise	0.43	4
Atrium		
... that is $\leq$40' in height	0.03 per foot in total height	NA
... that is > 40' in height	0.40 + 0.02 per foot in total height	NA
Banking Activity Area	1.01	6
Breakroom (See Lounge/Breakroom)		
Classroom/Lecture Hall/Training Room		
... in a penitentiary	1.34	4
... otherwise	1.24	4
Conference/Meeting/Multipurpose Room	1.23	6
Confinement Cells	0.81	6
Copy/Print Room	0.72	6
Corridor[2]		
... in an Assisted Living Facility (and used primarily by residents)[3]	0.92	Width < 8'
... in a hospital	0.79	Width < 8'
... in a manufacturing facility	0.41	Width < 8'
... otherwise	0.66	Width < 8'
Courtroom	1.72	6
Computer Room	1.71	4
Dining Area		
... in a penitentiary	0.96	6
... in an Assisted Living Facility (and used primarily by residents)[3]	1.90	4
... in Bar/Lounge or Leisure Dining	1.07	4
... in Cafeteria or Fast Food Dining	0.65	4
... in Family Dining	0.89	4
... otherwise	0.65	4
Electrical/Mechanical Room	0.42	6
Emergency Vehicle Garage	0.56	4
Food Preparation Area	1.21	6
Guest Room	0.47	6

Laboratory		
… in or as a classroom	1.43	6
… otherwise	1.81	6
Laundry/Washing Area	0.60	4
Loading Dock, Interior	0.47	6
Lobby		
… in an Assisted Living Facility (and used primarily by residents)[3]	1.80	4
… for an elevator	0.64	6
… in a hotel	1.06	4
… in a motion picture theater	0.59	4
… in a performing arts theater	2.00	6
… otherwise	0.90	4
Locker Room	0.75	6
Lounge/Breakroom		
… in a healthcare facility	0.92	6
… otherwise	0.73	4
Office		
… enclosed	1.11	8
… open plan	0.98	4
Parking Area, Interior	0.19	4
Pharmacy Area	1.68	6
Restroom		
… in an Assisted Living Facility (and used primarily by residents)[3]	1.21	8
… otherwise	0.98	8
Sales Area[4]	1.59	6
Seating Area, General	0.54	4
Stairwell	0.69	10
Storage Room	0.63	6
Vehicular Maintenance Area	0.67	4
Workshop	1.59	6

1 - In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply
2 - In corridors, the extra LPD allowance is permitted when the width of the corridor is less than 8' and is not based on the RCR
3 - ***An 'Assisted Living Facility' is a*** residential facility, for people with special needs or disabilities, that provides help with everyday tasks such as bathing, dressing, and taking medication.
4 - For accent lighting, see Section 9.6.2(b)

Building Type Specific Space Types	**LPD watts/sq.ft**	**RCR Threshold**
Assisted Living Facility[3]		
… in a chapel (used primarily by residents)	2.21	4
… in a recreation room (used primarily by residents)	2.41	6
Automotive (See Vehicular Maintenance Area above)		
Convention Center - Exhibit Space	1.45	4
Dormitory - Living Quarters	0.38	8
Fire Station - Sleeping Quarters	~~0.25~~ 0.22	6
Gymnasium/Fitness Center		
… in an Exercise Area	0.72	4
… in a Playing Area	1.20	4
Healthcare Facility		
… in an Exam/Treatment Room	1.66	8
… in an Imaging Room	1.51	6
… in a Medical Supply Room	0.74	6

… in a Nursery	0.88	6
… in a Nurse's Station	0.71	6
… in an Operating Room	2.48	6
… in a Patient Room	0.62	6
… in a Physical Therapy Room	0.91	6
… in a Recovery Room	1.15	6
Library		
… in a Reading Area	1.06	4
… in the Stacks	1.71	4
Manufacturing Facility		
… in a detailed manufacturing area	1.29	4
… in an Equipment Room	0.74	6
… in an Extra High Bay Area (> 50' floor-to-ceiling height)	1.05	4
… in a High Bay Area (25-50' floor-to-ceiling height)	1.23	4
… in a Low Bay Area (< 25' floor-to-ceiling height)	1.19	4
Museum		
… in a General Exhibition Area	1.05	6
… in a Restoration Room	1.02	6
Performing Arts Theater - Dressing Room	0.61	6
Post Office - Sorting Area	0.94	4
Religious Buildings		
… in a Fellowship Hall	0.64	4
… in a Worship/Pulpit/Choir Area	1.53	4
Retail Facilities		
… in a Dressing/Fitting Room	0.71	8
… in a Mall Concourse	1.10	4
Sports Arena - Playing Area		
… for a Class I facility	3.68	4
… for a Class II facility	2.40	4
… for a Class III facility	1.80	4
… for a Class IV facility	1.20	4
Transportation Facility		
… in a baggage/carousel Area	0.53	4
… in an Airport Concourse	0.36	4
… at a Terminal Ticket Counter	0.80	4
Warehouse - Storage Area		
…for medium to bulky, palletized items	0.58	4
… for smaller, hand-carried items[5]	0.95	6
5 - sometimes referred to as a 'Picking Area'.		

Reason: *This proposal modifies the Space-by-space lighting power density (LPD) table:*

1. *LPDs have been adjusted to account for changes to recommended light levels as published in the new, 10th Edition of the IES Lighting Handbook. Some values have gone up while others have gone down. As an average, the changed LPDs dropped 6%.*
2. *Three new space types have been added in response to user requests: (i) Copy/Print Rooms, (ii) Loading Docks, Interior and (iii) Computer rooms.*
3. *Also in response to user requests, new space types for Assisted Living Facilities were added including corridor, dining area, lobby, restroom, chapel and recreation room. In all cases these modified LPDs are restricted to those spaces that are used primarily by the residents.*
4. *Some space types were renamed for consistency.*
5. *Some table footnotes were added to provide more specific direction.*

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

CE311-13

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

C405.5.2-EC-FERGUSON.doc

CE312 – 13
C405.5.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4

Exceptions:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.
   - 1.1. Professional sports arena playing field lighting.
   - 1.2. Lighting in *sleeping units* ~~lighting in hotels, motels, boarding houses or similar buildings~~.
   - 1.3. Emergency lighting automatically off during normal building operation.
   - 1.4. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired visual impairment and other medical and age-related issues.
   - 1.5. Lighting in interior spaces that have been specifically designated as a reg-istered interior historic landmark.
   - 1.6. Casino gaming areas.
2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:
   - 2.1. Task lighting for medical and dental purposes.
   - 2.2. Display lighting for exhibits in galleries, museums and monuments.
3. Lighting for theatrical purposes, including performance, stage, film production and video production.
4. Lighting for photographic processes.
5. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
6. Task lighting for plant growth or maintenance.
7. Advertising signage or directional signage.
8. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
9. Lighting equipment that is for sale.
10. Lighting demonstration equipment in lighting education facilities.
11. Lighting *approved* because of safety or emergency considerations, inclusive of exit lights.
12. Lighting integral to both open and glass-enclosed refrigerator and freezer cases.
13. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

Reason: This proposal simplifies the exception to the interior lighting power in sleeping units. The definition of sleeping unit is such that there is no further need to delineate the building type in which the sleeping unit is located. In fact, the delineation suggests there are others that are not "similar" to hotels, motels, and boarding houses where the exception would not apply (e.g., dormitories).

Cost Impact: The code change proposal does not increase the cost of construction.

CE312-13

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

C405.5.1 #2-EC-WILLIAMS.doc

CE313 – 13
C405.5.1

Proponent: Vickie Lovell, InterCode Inc., representing the National Greenhouse Manufacturers Association (Vickie@intercodeinc.com)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4.

Exceptions:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.
    1.1. Professional sports arena playing field lighting.
    1.2. *Sleeping unit* lighting in hotels, motels, boarding houses or similar buildings.
    1.3. Emergency lighting automatically off during normal building operation.
    1.4. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired visual impairment and other medical and age-related issues.
    1.5. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
    1.6. Casino gaming areas.
2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:
    2.1. Task lighting for medical and dental purposes.
    2.2. Display lighting for exhibits in galleries, museums and monuments.
3. Lighting for theatrical purposes, including performance, stage, film production and video production.
4. Lighting for photographic processes.
5. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
6. ~~Task~~ Lighting for plant growth or maintenance.
7. Advertising signage or directional signage.
8. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
9. Lighting equipment that is for sale.
10. Lighting demonstration equipment in lighting education facilities.
11. Lighting *approved* because of safety or emergency considerations, inclusive of exit lights.
12. Lighting integral to both open and glass-enclosed refrigerator and freezer cases.
13. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

Reason: "Task" in Webster's Dictionary is defined as a "usually assigned piece of work often to be finished within a certain time", or "something hard or unpleasant that has to be done", neither of which can be applied to plant growth or maintenance. Webster's dictionary doesn't contain the phrase "task lighting" and there is no definition in the code. The application of this section of the code as written to any specific lighting in a greenhouse is completely subjective, and inconsistent.

"Lighting for plant growth or maintenance" is adequate to describe the type of lighting that is exempt from the lighting requirements of this code.

Cost Impact: The code change proposal will not increase the cost of construction.

CE313-13

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

C405.5.1-EC-LOVELL.doc

CE314 – 13
C405.5.1

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4.

Exceptions:

11. Lighting *approved* because of safety or emergency considerations, ~~inclusive of exit lights.~~

15. Exit signs.

(Portions of text not shown remains unchanged)

Reason: This change provides clarification to the code.
"Exit lights" is not an industry standard term and it is not clear what it means. It was likely meant to indicate exit signs, which should be a separate exception. Exit signs are a separate exception in Standard 90.1.

Cost Impact: The code change proposal will not increase the cost of construction.

CE314-13

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

C405.5.1 #2-EC-HEINMILLER.doc

CE315 – 13
C405.5.1.4

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.5.1.4 Line-voltage lighting track and plug-in busway. The wattage for line-voltage lighting tracks and plug-in busways shall be:

1. The specified wattage of the luminaires included in the system with a minimum of ~~30~~ 50 W/lin ft. (~~98~~ 162 W/lin. m);
2. The wattage limit of the system's circuit breaker; or
3. The wattage limit of other permanent current limiting devices on the system.

Reason: A recent study has shown that track lighting is typically loaded with 50 Watts per lineal foot, much more than the 30 W/LF in the current code.

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

CE315-13

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

C405.5.1.4-EC-NOGLER.doc

CE316 – 13
C405.5.2.1 (NEW), C405.5.2.2 (NEW), Table C405.5.2(2)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C405.5.2 Interior lighting power. The total interior lighting power allowance (watts) is determined according to Table C405.5.2(1) using the Building Area Method, or Table C405.5.2(2) using the Space-by-Space Method, for all areas of the building covered in this permit.

C405.5.2.1 Building area method. For the Building Area Method, the interior lighting power allowance is the floor area for each building area type listed in Table C405.5.2(1) times the value from Table C405.5.2(1) for that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type as listed in Table C405.5.2(1). Where this method is used to calculate the total interior lighting power for an entire building, each building area type shall be treated as a separate area.

C405.5.2.2 Space by space method. For the Space-by-Space Method, the interior lighting power allowance is determined by multiplying the floor area of each space times the value for the space type in Table C405.5.2(2) that most closely represents the proposed use of the space, and then summing the lighting power allowances for all spaces. Tradeoffs among spaces are permitted.

Exception: Additional lighting installed to highlight specific merchandise is permitted in accordance with the following:

1. The highlight lighting is switched or dimmed on circuits different from the circuits for general lighting.
2. The allowed lighting power shall be the smaller of the following:
   - 2.1, The actual wattage of the lighting equipment installed specifically for the merchandise; or
   - 2.2. The additional lighting determined in accordance with Equation 4-7.

   ARSA = 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6 W/ft^2) + (Retail Area 3 × 1.4 W/ft^2) + (Retail Area 4 × 2.5 W/ft^2). **(Equation 4-7)**

   where:

   ARSA =Additional interior retail sale lighting power allowance

   Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.
   Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.
   Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.
   Retail Area 4 = The floor area used for the sale of jewelry, crystal and china

   Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

3. The additional power determined in Item 2, shall be added to the interior lighting power determined for sales areas in Table C 405.5.2(2)

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES:
SPACE-BY-SPACE METHOD

(Portions of Table not shown remain unchanged)

~~a. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.~~

~~Calculate the additional lighting power as follows:~~

~~Additional Interior Lighting Power Allowance = 500 watts + (Retail Area 1 × 0.6 W/ft2) + (Retail Area 2 × 0.6 W/ft2) + (Retail Area 3 × 1.4 W/ft2) + (Retail Area 4 × 2.5 W/ft2).~~

~~where:~~

~~Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.~~

~~Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.~~

~~Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.~~

~~Retail Area 4 = The floor area used for the sale of jewelry, crystal and china~~

> ~~**Exception:** Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.~~

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.
: The existing footnote a is an exception to the table. It is unusual in its format and distinctly different in its format from the typical format of International Codes. The footnote is a very important allowance for retail sales establishments. The footnote is also unusual in that it contains an equation as well as an exception to the equation.

The proposal does 3 things:

1. It moves the retail lighting exception from being a footnote at the end of a long table to a more prominent position in the text of the code directing the code users to the tables.
2. It reformats the provision into a series of items which more clearly specify the requirements and limits of the exception. It allows the equation to be numbered as all equations in the IECC are numbered.
3. It replaces the 'exception within the exception' to being a portion of the criteria – and properly identifies the code official as the person who will approve the additional display lighting.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE316-13

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

C405.5.2.1 (NEW)-EC-THOMPSON-SEHPCAC

CE317 – 13
C405.5.3 (New), Table C405.5.2(2)

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.3 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following case:

1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, the additional lighting power shall be determined in accordance with Equation 4-X

   Additional Interior Lighting Power Allowance = 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6 W/ft^2) + (Retail Area 3 × 1.4 W/ft^2) + (Retail Area 4 × 2.5 W/ft^2). Equation 4-x

   where:

   Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.
   Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.
   Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.
   Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

   Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES:
SPACE-BY-SPACE METHOD

(Portions of table not shown remain unchanged)

~~a.~~ ~~Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.~~

~~Calculate the additional lighting power as follows:~~

~~Additional Interior Lighting Power Allowance = 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6 W/ft^2) + (Retail Area 3 × 1.4 W/ft^2) + (Retail Area 4 × 2.5 W/ft^2).~~

~~where:~~

~~Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.~~
~~Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.~~
~~Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.~~
~~Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.~~

~~**Exception:** Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.~~

Reason: Adds clarity to the code. The provision is too lengthy for a footnote. Formula has been properly listed. “Authority having jurisdiction” changed to “code official”.

Cost Impact: The code change proposal will not increase the cost of construction.

CE317-13

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

C405.5.3 (NEW)-EC-HEINMILLER rev.doc

CE318 – 13
C405.6

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.6 Exterior lighting (Mandatory). Where the power for exterior lighting is supplied through the energy service to the building, all exterior lighting~~, other than low-voltage landscape lighting,~~ shall comply with Sections C405.6.1 and C405.6.2.

Exception: Where *approved* because of historical, safety, signage or emergency considerations.

Reason: There is no reason that low-voltage landscape lighting should be excluded from the total exterior lighting power allowance. In many applications, the contribution of multiple low-voltage fixtures is substantial.

Cost Impact: The code change proposal will not increase the cost of construction.

CE318-13

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

C405.6-EC-NOGLER.doc

CE319 – 13
C405.6, C405.6.1, C405.6.2

Proponent: Glenn Heinmiller, Lam Partners, International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.6 Exterior lighting (Mandatory). Where the power for exterior lighting is supplied through the energy service to the building, all exterior lighting, ~~other than low-voltage landscape lighting~~, shall comply with Section~~s~~ ~~C405.6.1 and~~ C405.6.2.

> **Exception:** Where *approved* because of historical, safety, signage or emergency considerations.

~~**C405.6.1 Exterior building grounds lighting.** All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section C405.6.2.~~

C405.6.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated and are permitted in Table C405.6.2(2) for the applicable lighting zone. Tradeoffs are allowed only among exterior lighting applications listed in Table C405.6.2(2), Tradable Surfaces section. The lighting zone for the building exterior is deter- mined from Table C405.6.2(1) unless otherwise specified by the local jurisdiction. ~~Exterior lighting for all applications (except those included in the exceptions to Section C405.6.2) shall comply with the requirements of Section C405.6.1.~~

> **Exception:** Lighting used for the following exterior applications is exempt where equipped with a control device independent of the control of the nonexempt lighting:
>
> 1. Specialized signal, directional and marker lighting associated with transportation;
> 2. Advertising signage or directional signage;
> 3. Integral to equipment or instrumentation and is installed by its manufacturer;
> 4. Theatrical purposes, including performance, stage, film production and video production;
> 5. Athletic playing areas;
> 6. Temporary lighting;
> 7. Industrial production, material handling, transportation sites and associated storage areas;
> 8. Theme elements in theme/amusement parks; and
> 9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

Reason: Simplify the code without reducing stringency.
C405.6 -The exemption of “low-voltage landscape lighting” makes no sense and adds unnecessary complexity. This exemption is not in Standard 90.1.
C405.6.1 This is an obsolete and redundant provision that should have been removed from IECC when the lighting power density method was introduced for exterior lighting. The provision adds no value to the code and increases complexity.

Cost Impact: The code change proposal will not increase the cost of construction.

CE319-13

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

C405.6-EC-HEINMILLER.doc

CE320 – 13
Table C405.6.2(1)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

TABLE C405.6.2(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas <u>not classified as lighting zone 1, 2 or 4.</u>
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Reason: This proposal clarifies the exterior lighting zone requirements to indicate that Zone 3 includes all areas that are not classified as lighting Zone 1, 2, or 4. The new language clarifies the meaning of “other areas.” The objective of this proposal is to clarify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal will not increase the cost of construction.

CE320-13

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

C405.6.2(1)T-EC-WILLIAMS.doc

CE321 – 13
Table C405.6.2(2)

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

TABLE C405.6.2(2)
INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

		LIGHTING ZONES			
		Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance (Base allowance is usable in tradable or nontradable surfaces.)		500 W	600 W	750 W	1300 W
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas are tradable.)	**Uncovered Parking Areas**				
	Parking areas and drives	0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	0.13 W/ft^2
	Building Grounds				
	Walkways less than 10 feet wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater, plaza areas special feature areas	0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways	0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian tunnels	0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Building Entrances and Exits				
	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry canopies	0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
	Sales Canopies				
	Free-standing and attached	0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	1.0 W/ft^2
	Outdoor Sales				
	Open areas (including vehicle sales lots)	0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	0.7 W/ft^2

	Street frontage for vehicle sales lots in addition to "open area" allowance	No allowance	10 W/linear foot	10 W/linear foot	30 W/linear foot
Nontradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)	Building facades	No allowance	~~0.1 W/ft^2 for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length~~ 0.075 W/ft^2 of gross above-grade wall area	~~0.15 W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length~~ 0.113 W/ft^2 of gross above-grade wall area	~~0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length~~ 0.15 W/ft^2 of gross above-grade wall area
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded facilities	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area
	Drive-up windows/doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24-hour retail entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2.

Reason:
How do you calculate the area of illuminated wall or surface? This sounds straightforward, but in many cases it is not. Consider the following examples:

1. Low wattage uplights are installed at the bottom of a 20-story building. By the time the light gets to the third or fourth floor it is not perceptible. What is the illuminated wall area? The entire 20-story façade, since some infinitesimally small amount of light reaches the top? Or only that portion of the façade that receives perceptible light? Perceptible to whom - the code official or the designer?
2. Lighting is proposed for the TV antenna at the top of a high-rise building (antennas are common on very tall buildings like the Freedom Tower in New York City). The antenna is an open space frame. How do you calculate the surface area?
3. Lights are integrated into a building façade to light directly out away from the building (this is common on casinos). No building façade surface area is illuminated. What is the lighting power allowance? Does the code only allow illumination of building surfaces, but not direct-view lighting applications?

In all of these examples the code is unclear and unenforceable.

This proposal would substitute the term "gross above-grade wall area" instead of "illuminated wall or surface area". "Gross above-grade wall area" already has to be determined to show compliance with the fenestration provisions in C402.3 and is a much more readily understood term.

To avoid making the code less efficient, lower W/ft^2 values are proposed for Table C405.6.2. These values are 75% of current code values, which means that a building which has lighting on 75% of its' above-grade wall area will get the same allowance as under current code. A building which has less than 75% of its' façade lighted will get a larger allowance than under current code, and a building which has more than 75% of its' façade lighted will get a smaller allowance than under current code.

Cost Impact: The code change proposal will not increase the cost of construction

CE321-13

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

C405.6.2(2)T-EC-BAILEY.doc

CE322 – 13
C405.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.7 Electrical energy consumption (mandatory). ~~In buildings having individual~~ Every dwelling units~~, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units~~ in Use Group R-2 buildings shall have a separate electrical meter.

Reason: This proposal simplifies the electrical metering requirements to indicate that the dwelling units in Use Group R-2 buildings must be separately metered. The intent is to apply to R-2 buildings and there is no need to indicate in the code the reason for the criterion; only what is required. This will simplify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal does not increase the cost of construction.

CE322-13

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

C405.7-EC-WILLIAMS.doc

CE323 – 13
C405.7, C405.7.1 (NEW), C405.7.2 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.7 Electrical energy consumption (Mandatory). ~~In buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units~~. Meters, metering devices or other provisions shall be installed capable of determining the electrical energy consumed by and within the building in accordance with this section.

C405.7.1 Multi-family residential buildings. In buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed within each dwelling unit by separately metering individual dwelling units.

C405.7.2 Buildings other than multi-family residential buildings. Metering devices capable of measuring electrical energy use shall be provided for the total electrical energy system, HVAC systems, interior lighting systems, exterior lighting systems and receptacle circuits in each building and, for other than shared systems, each separate tenancy within the building. The measurement devices shall have the capability to record electrical energy use at least every 15 minutes and report that use on at least an hourly, daily, monthly and annual basis and retain the recorded data at least 36 months.

Exceptions: Metering devices are not required for the following spaces and systems:

1. Buildings less than 10,000 square feet in net floor area.
2. Individual tenant spaces less than 5,000 square feet in net floor area.
3. Dwelling units
4. Residential buildings with less than 10,000 square feet of common area.
5. Critical and equipment branches covered in the Article 517 of NFPA 70

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised with respect to energy metering. The change ensures continued consistency between the IECC and standard 90.1-2010. It retains the current provisions in the IECC for multi-family residential buildings and then includes electrical metering provisions for other building types and occupancies.

Cost Impact: The code change proposal will increase the cost of construction when monitoring devices are required.

CE323-13

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

C405.7-EC-FERGUSON.doc

CE324 – 13
C405.8 (NEW), C405.8.1 (NEW), Table C405.8.1 (NEW), Chapter 5

Proponent: Jim Edelson, New Buildings Institute (jedelson@comcast.net)

Add new text as follows:

C405.8 Energy distribution design and load type segregation (mandatory). Energy distribution systems within, on or adjacent to and serving a building shall be designed such that each circuit or panel supplies only one end-use category listed in Table 405.8.1. The end-use category served by each distribution system shall be clearly designated on the energy distribution system with the load served, and adequate space shall be provided for installation of energy measurement equipment or other data collection devices to measure their energy use. The energy distribution system shall be designed to facilitate the collection of data for each of the load types.

Exceptions:

1. Not more than 5 percent of the segregated load for each of the categories listed in Table 405.8.1 is permitted to be from a load not within that category.
2. Critical and Equipment Branches of Article 517 of NFPA 70 are not required to meet the requirements of this section.
3. Buildings where the load types in listed in Table 405.8.1 are measured separately through the installation of equipment in accordance with Section C405.8.1 are not required to meet the requirements of this section.
4. Individual tenant spaces having a floor area not greater than 2500 square feet and equipped with one or more source meters in accordance with Section C405.8.1 are not required to meet the requirements of this section.

TABLE 405.8.1
ENERGY USE CATEGORIES

Load Category	Description of energy use
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120 volt equipment, or 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system.
Interior lighting	Lighting systems located within the *building.*
Exterior lighting	Lighting systems located on the *building site* but not within the *building.*
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets
Process loads	Any single load not included in a HVAC, lighting, or plug load category that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, and snow-melt systems.

C405.8.1 Meters. Meters and other measurement devices shall be configured to automatically communicate energy data to a data acquisition system. Lighting, HVAC, or other building systems that can monitor their energy consumption are permitted instead of meters. The meters, measurement devices, or building systems that monitor their energy consumption shall have a tested accuracy of +/-5 percent.

Add new standard to Chapter 5 as follows:

NFPA

70-11 National Electrical Code

Reason: Measurement of the energy consumption of the different kinds of loads in a building is a powerful diagnostic and benchmarking tool. The diagnostic value of segregated loads is being demonstrated in a growing number of energy modeling and management tools.

Segregating loads at the circuit and panel level provides the significant advantage that it makes the load types capable of being easily and less expensively metered or measured in the future. Through segregating the loads in the building's energy distribution infrastructure, the primary load types of a building can be monitored with only a handful of measurement devices. Permanent measurement or metering devices can be added later, or temporary devices can be installed for a short period of diagnostics and/or benchmarking.

For example, a campus of buildings in Seattle had plans for two nearly identical buildings, one mostly constructed and the other in the design phase. There was a desire for more information about the plug loads in the buildings, so the decision was made to sub-meter just that load type. The first building's energy distribution infrastructure had been designed without load-type segregation in mind, so measuring just the plug loads would have required 104 sub-meters. Since the other building was still in the design phase, its energy infrastructure was designed so that the plug loads would be segregated from the other building loads resulting in the need for only 4 sub-meters. The change in design to the system resulted in a minimal cost impact, but the reduction in the number of meters required resulted in significant cost savings.

Cost Impact: The code change proposal will not increase the cost of construction.

CE324-13

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

C405.8 (NEW)-EC-EDELSON.doc

CE325 – 13
C405.8 (NEW)

Proponent: Andrei Moldoveanu, National Electrical Manufacturers Association (NEMA) (and_moldoveanu@nema.org), Jim Edelson, New Buildings Institute (NBI) (jedelson@comcast.net)

Add new text as follows:

C405.8 Energy monitoring (Mandatory). Buildings with a gross conditioned floor area over 25,000 square feet shall comply with Sections C405.8.1 through C405.8.5. Buildings shall be equipped to measure, monitor, record and report energy consumption data for each energy source and end use category.

> **Exception:** Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and provided it has less than 5000 square feet of conditioned floor area.

C405.8.1 Energy type metering. For each energy type listed in Table 405.8.1, meters, or other measurement devices, shall collect energy data for the whole building.

Exceptions:

1. Energy type metering is not required where end-use metering, as described in Section C405.8.3, for an energy type accounts for all usage of that energy type within a building, and the data acquisition system totals the energy delivered to the building or separately-metered portion of the building.
2. Solid fuels including but not limited to, coal, firewood or wood pellets that are delivered via mobile transportation do not require metering.

TABLE 405.8.1
ENERGY TYPE CATEGORIES

Type category	Description of energy type
Electrical Energy	Electrical energy supplied to the building or building site..
Gas and liquid fuel supply energy	Gas and liquid fuel supplied to the building or building site..
District Energy	This category shall include all net energy extracted from district steam systems, district chilled water loops, district hot water systems, or other energy sources serving multiple buildings, and supplied to the building or building site.
On-site renewable energy	This category shall include all energy generated from *on-site renewable energy* and supplied to the building or building site.

C405.8.2 End-use metering. Meters or other measurement devices shall be provided to collect energy use data for each end-use category listed in Table 405.8.2. These meters shall collect data for the whole building or for each separately metered portion of the building where permitted by the Exception to Section C405.8. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2. End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.

3.. End use metering is not required for an individual tenant space having a floor area not greater than 2500 square feet where a dedicated source meter complying with Section C405.8.3 is provided.

4. Not more than 5 percent of the measured load for each of the categories listed in Table 405.8.2 is permitted to be from a load not within that category.

TABLE 405.8.2
ENERGY USE CATEGORIES

Load Category	Description of energy use
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior lighting	Lighting systems located within the *building.*
Exterior lighting	Lighting systems located on the *building site* but not within the *building.*
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets
Process loads	Any single load that is not included in a HVAC, lighting, or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, and snow-melt systems.

C405.8.3 Meters. Meters and other measurement devices required by Section C405.8 shall be configured to automatically communicate energy data to a data acquisition system. Lighting, HVAC, or other building systems that can monitor their energy consumption are permitted instead of meters. The meters, measurement devices, or building systems that monitor their energy consumption shall have a tested accuracy of +/-5 percent or better. All required metering systems and equipment shall provide at least hourly data that is fully integrated into a data acquisition and display system in accordance with Section C405.8.4 and Section C405.8.5.

C405.8.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. For each energy supply and end use category required by Sections C405.8.2 and C405.8.3, it shall provide real-time energy consumption data and logged data for any hour, day, month or year.

C405.8.5 Graphical energy report. For each building subject to Sections C405.8.1 and C405.8.2, a permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall be capable of graphically displaying the energy consumption for each end-use category specified in Section C405.8.2 by the hour, day, month and year for the previous 36 months.

Reason: This proposal saves energy by providing actionable and timely energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). Estimates in available literature of the energy savings to be expected from metering and monitoring systems vary from 2% to 15%. The effectiveness of each system depends on owners and facility managers observing and acting upon the data provided. Additionally, the 2013 versions of ASHRAE Std. 90.1 and California Title 24 will be requiring energy monitoring.

Cost Impact: The code change proposal will not increase the cost of construction.

CE325-13

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

C405.8 (NEW)-EC-EDELSON-MOLDOVEANU.doc

CE326 – 13
C405.8 (NEW)

Proponent: Wayne Stoppelmoor, Schneider Electric (wayne.stoppelmoor@schneider-electric.com)

Add new text as follows:

C405.8 Energy monitoring (Mandatory). Buildings with a gross conditioned floor area over 25,000 square feet shall comply with Section C405.8.1 through C405.8.5. Buildings shall be equipped to measure, monitor, record and report energy consumption data for each end-use category required by Section C405.8.2.

> **Exception:** Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area.

C405.8.1 Electrical energy metering. For electrical energy, including all electrical energy supplied to the building and its associated site, including but limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.8.2.

C405.8.2 End-use metering categories. Meters or other measurement devices shall be provided to collect energy use data for each end-use category listed in Table 405.8.1. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories listed in Table 405.8.1 is permitted to be from a load not within that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2. End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.
3. End-use metering is not required for and individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.8.3 is provided.

TABLE 405.8.1
ENERGY USE CATEGORIES

Load Category	Description of energy use
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior lighting	Lighting systems located within the *building.*
Exterior lighting	Lighting systems located on the *building site* but not within the *building.*
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets
Process loads	Any single load that is not included in a HVAC, lighting, or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, and snow-melt systems.

C405.8.3 Meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.8.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of +/-2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.8.4 and C405.8.5.

C405.8.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C405.8.2.

C405.8.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.8.2 at least every hour, day, month and year for the previous 36 months.

Reason: This proposal saves energy by providing actionable and timely energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). Estimates in available literature of the energy savings to be expected from metering and monitoring systems vary from 2% to 15%. The effectiveness of each system depends on owners and facility managers observing and acting upon the data provided. Additionally, the 2013 version of ASHRAE Std. 90.1 and several state energy codes will be requiring energy monitoring.

Cost Impact: This requirement will cause a modest increase to the cost of construction. However, such increase in cost will be recovered in a short period of time due to the decreased energy consumed in the building.

.

CE326-13

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

C405.8 (NEW)-EC-STOPPELMOOR.doc

CE327 – 13
C405.8 (NEW)

Proponent: Andrei Moldoveanu, National Electrical Manufacturers Association (NEMA) (and_moldoveanu@nema.org), Jim Edelson, New Buildings Institute (NBI)

Revise as follows:

C405.8 Energy Monitoring (Mandatory). Buildings with a gross conditioned floor area over 25,000 ft^2 shall comply with Sections C405.8.1 through C405.8.6. Buildings shall be equipped to measure, monitor, record and report energy consumption data for each energy source and end use category.

> **Exception:** Tenant spaces within buildings if the tenant space has its own utility services and utility meters and is less than 5,000 square feet gross conditioned floor area.

C405.8.1 Alternate metering methods. Where approved by the building official, energy use metering systems may differ from those required by this section, provided that they are permanently installed and that the source energy measurement, end use category energy measurement, data storage and report have similar accuracy to and are at least as effective in communicating actionable energy use information to the building management and users, as those required by this section.

C405.8.2 Energy type metering. For each energy type listed in sections C405.8.2.1 through C405.8.2.4, meters shall collect data for the whole building.

Exceptions:

1. Energy type metering is not required where end-use metering, as describe in section C405.8.3, for an energy type accounts for all usage of that energy type within a building, and the data acquisition system totals the energy delivered to the building or separately-metered portion of the building.
2. Solid fuels such as coal, firewood or wood pellets that are delivered via mobile transportation do not require metering.
3. Up to 5 percent of the measured load for each of the categories described in sections C405.8.3.1 through C405.8.3.3 shall be allowed to be from any other loads.

C405.8.2.1 Electrical energy. This category shall include all electrical energy supplied to the building.

C405.8.2.2 Gas and liquid fuel supply energy. This category shall include all natural gas, fuel oil, propane and other gas or liquid fuel energy supplied to the building.

C405.8.2.3 District energy. This category shall include all net energy extracted from district steam systems, district chilled water loops, district hot water systems, or other energy sources serving multiple buildings, and supplied to the building.

C405.8.2.4 Site-generated renewable energy. This category shall include all energy generated from on-site solar, wind, geothermal, tidal or other natural sources, and supplied to the building.

C405.8.3 End-use metering. Meters shall be provided to collect energy use data for each end-use category listed in sections C405.8.3.1 through C405.8.3.5. These meters shall collect data for the whole building or for each separately metered portion of the building where permitted by the Exception to Section C405.8. Multiple meters may be used for any end-use category, provided that the data acquisition system totals all of the energy used by that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2. Separate metering is not required for fire pumps, stairwell pressurization fans or other life safety systems that operate only during testing or emergency.
3. End use metering is not required for individual tenant spaces not exceeding 2,500 square feet in floor area when a dedicated source meter meeting the requirements of Section C405.8.4 is provided for the tenant space.

C405.8.3.1 HVAC system total energy use. This category shall include all energy used to heat, cool, and provide ventilation to the building including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.

Exceptions:

1. All 120 volt equipment.
2. 208/120 volt equipment in a building where the main service is 480/277 volt power.

C405.8.3.2 Interior lighting system total energy use. This category shall include all interior lighting.

C405.8.3.3 Exterior lighting system total energy use. This category shall include all exterior lighting that is powered through the energy service to the building.

C405.8.3.4 Plug loads. This category shall include all energy use by devices, appliances and equipment connected to convenience receptacle outlets.

C405.8.3.5 Process loads. Process or other loads not covered in C405.8.3.1 through C405.8.3.3 that exceed 5% of the total energy use of the whole building.

C405.8.4 Meters. Meters and other measurement devices required by Section C405.8shall be configured to automatically communicate energy data to a data acquisition system. Source meters may be any digital-type meters. Current sensors or flow meters are allowed for end use metering, provided that they have a tested accuracy of +/-2 percent. All required metering systems and equipment shall provide at least hourly data that is fully integrated into the data acquisition and display system per the requirements of Section C405.8.

C405.8.5 Data acquisition system. A data acquisition system shall store the data from the required meters and other sensing devices for a minimum of 36 months. For each energy supply and end use category required by C405.8.2 and C405.8.3, it shall provide real-time energy consumption data and logged data for any hour, day, month or year.

C405.8.6 Graphical energy report. For each building subject to Section C405.8.2 and C405.8.3, a permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall be capable of graphically displaying the energy consumption for each end-use category specified in C405.8.3 by the hour, day, month and year for the previous 36 months.

Reason: This proposal saves energy by providing actionable and timely energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). Estimates in available literature of the energy savings to be expected from metering and monitoring systems vary from 2% to 15%. The effectiveness of each system depends on owners and facility managers observing and acting upon the data provided. Additionally, the 2013 version of ASHRAE Std. 90.1 and several state energy codes will be requiring energy monitoring.

Cost Impact: The code change proposal will not increase the cost of construction.

CE327-13

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

CE328 – 13
C405.8 (NEW), C405.8.1 (NEW), C405.8.2 (NEW)

Proponent: Jim Edelson, New Buildings Institute (jedelson@comcast.net), Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Add new text as follows:

C405.8 Requirements for solar-ready energy systems (Mandatory). In climates zones 1 through 6, infrastructure shall be provided within the building and space shall be allocated on the roof for future installation of on-site renewable energy systems. The infrastructure and allocated roof space shall be capable of accommodating an energy system with a minimum rating of 3.7 W/ft^2 or 13 Btu/h·ft^2 (40 W/m^2) multiplied by the total roof area in square feet (m^2) and shall comply with Section C405.8.2. Compliance with this section shall be documented as specified in Section C405.8.1.

Exceptions:

1. The portion of the total roof area shaded during the peak sun angle on the summer solstice by natural objects, permanent features of the building or by permanent features of adjacent buildings can be excluded from the total roof area for the purposes of this section.
2. Buildings incorporating an on-site renewable energy systems with a minimum rating of 3.7 W/ft^2 or 13 Btu/h·ft^2 (40 W/m^2) multiplied by the total roof area in square feet (m^2) do not have to meet the requirements of this section.
3. Buildings with four or more stories do not have to meet the requirements of this section .
4. Additions, alterations and repairs to existing buildings do not have to meet the requirements of this section.

C405.8.1 Documentation. Construction documents shall show allocated space and pathways for installation of on-site solar energy systems and associated infrastructure. Documents shall indicate a pathway for one of the following:

1. A pathway for routing of conduit from the roof or alternate reserved space to the main electrical service panel.
2. A pathway for routing of plumbing from the roof or alternate reserved space to the water-heating system.

C405.8.2 Building service for renewable systems. For solar electric the main electrical service panel shall have a minimum busbar rating sufficient to accommodate the power supply from the system and shall have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation. The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location and shall be permanently labeled with “For Solar Electric”.

Reason: This proposal provides for the option of installing a future on-site renewable energy system. Design alternatives for renewable systems are generally most plentiful and at the lowest cost at the time of new construction. As the cost of solar energy systems continues to fall, a building’s value can be enhanced by providing for the future installation of on-site renewable systems if they are not installed at the time of new construction.

The technical requirements in the proposal are based on values from Title 24 and ASHRAE 189.1 - 2008. The 3-story limitation in this proposal matches the broadest height exclusion in Title 24. The climate zone limits generally follow the annual insolation level of 4 kwh per square meter (source: NREL Flat Plate PV Solar Radiation map). The minimum equipment size ratings are based on ASHRAE 189.1.

The 2011 CASE study for the Title 24 solar-ready measure states: “The proposed code change does not require equipment installation nor does it have any incremental maintenance costs. The only costs associated with the measure are design costs. Initially designers will need to familiarize themselves with the solar-ready requirement, but over time design will become streamlined and the costs will be minimal.

Cost savings from retrofits will result when photovoltaic or solar water heating equipment is easily interconnected with the building electrical or plumbing systems. Installing PV or SWH systems on solar-ready buildings (as defined in the recommended code language) could reduce the installed cost of the system by as much as 10 percent.”

Cost Impact: The code change proposal will not increase the cost of construction.

CE328-13

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

C405.8 (NEW)-EC-EDELSON-MAKELA.doc

CE329 – 13
C405.8 (NEW), Table C405.8 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.8 Electrical transformers (Mandatory). Electric transformers shall meet the minimum efficiency requirements of Table C405.8 as tested and rated in accordance with the test procedure listed in DOE 10 CFR 431. The efficiency shall be verified through certification under an approved certification program or, where no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the transformer manufacturer.

Exceptions: The following transformers are exempt:

1. Transformers that meet the Energy Policy Act of 2005 exclusions based on the DOE 10 CFR 431 definition of special purpose applications.
2. Transformers that meet the Energy Policy Act of 2005 exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431
3. Transformers that meet the Energy Policy Act of 2005 exclusions with multiple voltage taps where the highest tap is at least 20 percent more than the lowest tap.
4. Drive transformers
5. Rectifier transformers
6. Auto-transformers
7. Uniterruptible power system transformers
8. Impendance transformers
9. Regulating transformers
10. Sealed and nonventilating transformers
11 Machine tool transformer
12. Welding transformer
13. Grounding transformer
15. Testing transformer

TABLE C405.8
Minimum Nominal Efficiency Levels for 10 CFR 431 Low Voltage Dry-Type Distribution Transformers

Single Phase Transformers		Three Phase Transformers	
kVA[a]	**Efficiency (%)[b]**	**kVA[a]**	**Efficiency (%)[b]**
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

a. kiloVolt-Amp rating.
b. Nominal efficiencies shall be established in accordance with the DOE 10 CFR 431 test procedure for low voltage dry-type transformers.

Add new definitions as follows:

<u>**LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMER**: A transformer that is air-cooled, does not use oil as a coolant, has an input voltage less than or equal to 600 Volts, and is rated for operation at a frequency of 60 Hertz</u>

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised with respect to electric low-voltage dry-type transformer efficiency provisions, an issue that is not currently addressed in the IECC Commercial Provisions. The change ensures continued consistency between the IECC and standard 90.1-2010/2013 and addresses an important component associated with improving building energy efficiency.

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

CE329-13

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

C405.8 (NEW)-EC-FERGUSON.doc

CE330 – 13
C202 (NEW), C405.8 (NEW)

Proponent: Duane Jonlin, City of Seattle representing City of Seattle Department of Planning and Development (duane.jonlin@seattle.gov)

Add new text as follows:

C405.8 Controlled receptacles. At least 50 percent of all 125 volt 15- and 20-ampere receptacles installed in private offices, open offices or classrooms, including those installed in modular partitions and modular office workstation systems, shall be *controlled receptacle* circuits. In rooms larger than 200 square feet, a *controlled receptacle* shall be located within 12 inches of each uncontrolled receptacle. *Controlled receptacles* shall be visibly differentiated from standard receptacles and shall be controlled by one of the following *automatic control devices:*

1. An occupant sensor that turns receptacle power off when no occupants have been detected for 30 minutes, or

2. 2. A time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. An independent program schedule shall be provided for areas no larger than 25,000 square feet but not more than one floor. The device shall be capable of being overridden for periods of up to two hours by a timer accessible to occupants. Any individual override switch shall control the *controlled receptacles* for a maximum area of 5,000 square feet (465 m^2). Override switches for *controlled receptacles* are permitted to control the lighting for the same area.

Exception: Receptacles designated for specific equipment requiring 24-hour operation, for building maintenance functions or for safety or security equipment are not required to be controlled by an *automatic control device* and are not required to be located adjacent to a *controlled receptacle*.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

AUTOMATIC CONTROL DEVICE. A device capable of automatically turning loads off and on without manual intervention.

CONTROLLED RECEPTACLE. An electrical receptacle that is controlled by an *automatic control device.*

Reason: Office equipment represents approximately 20 % of commercial building electrical use, and the trend is for this use to increase over time. This proposal would make two sets of receptacles available to occupants, so that continuous power is available for equipment that requires it, while other elements such as monitors, desk lamps and copy machines can be automatically shut down during night and weekend hours. Studies done for the California Energy Commission demonstrate that the potential energy savings from such control systems are substantial, with simple paybacks between 3 and 8 years for large offices.

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

CE330-13

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

C405.8 (NEW)-EC-JONLIN.doc

CE331 – 13

C405.8 (NEW), Table C405.8(1) (NEW), Table C405.8(2) (NEW), C405.8(3) (NEW), Table C405.8(4) (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.8 Electrical motors (Mandatory). Electric motors shall meet the minimum efficiency requirements of Tables C405.8 (1) through C405.8 (4) when tested and rated in accordance with the DOE 10 CFR 431. The efficiency shall be verified through certification under an approved certification program or, where no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the motor manufacturer.

Table C405.8 (1)
Minimum Nominal Full-Load Efficiency for 60 HZ NEMA *General Purpose Electric Motors (Subtype I)* Rated 600 Volts or Less (Random Wound)[a]

	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ⇒	**2**	**4**	**6**	**2**	**4**	**6**
Synchronous Speed (RPM)	**3600**	**1800**	**1200**	**3600**	**1800**	**1200**
Motor Horsepower						
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93.0	91.7	91.0	92.4	91.7
20	91.0	93.0	92.4	91.0	93.0	91.7
25	91.7	93.6	93.0	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93.0	94.5	94.1	93.0	94.5	94.1
60	93.6	95.0	94.5	93.6	95.0	94.5
75	93.6	95.0	94.5	93.6	95.4	94.5
100	93.6	95.4	95.0	94.1	95.4	95.0
125	94.1	95.4	95.0	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95.0	95.8	95.4	95.4	96.2	95.8
250	95.0	95.8	95.4	95.8	96.2	95.8
300	95.4	95.8	95.4	95.8	96.2	95.8
350	95.4	95.8	95.4	95.8	96.2	95.8

400	95.8	95.8	95.8	95.8	96.2	95.8
450	95.8	96.2	96.2	95.8	96.2	95.8
500	95.8	96.2	96.2	95.8	96.2	95.8

a Nominal efficiencies shall be established in accordance with DOE 10 CFR 431.

Table C405.8 (2)
Minimum Nominal Full-Load Efficiency of *General Purpose Electric Motors (Subtype II)* and all Design B motors greater than 200 horsepower[a]

	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles ==>	**2**	**4**	**6**	**8**	**2**	**4**	**6**	**8**
Synchronous Speed (RPM)==>	**3600**	**1800**	**1200**	**900**	**3600**	**1800**	**1200**	**900**
Motor Horsepower								
1	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
350	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500	95.8	95.8	NR	NR	95.4	95.8	NR	NR

a Nominal efficiencies shall be established in accordance with DOE 10 CFR 431.

NR—No requirement

Table C405.8 (3)
Minimum Average Full Load Efficiency for Polyphase *Small Electric Motors*[a]

Open Motors			
Number of Poles ==>	**2**	**4**	**6**
Synchronous Speed (RPM)	**3600**	**1800**	**1200**
Motor Horsepower			
0.25	65.6	69.5	67.5
0.33	69.5	73.4	71.4
0.50	73.4	78.2	75.3
0.75	76.8	81.1	81.7
1	77.0	83.5	82.5
1.5	84.0	86.5	83.8
2	85.5	86.5	N/A
3	85.5	86.9	N/A

[a] Average full load efficiencies shall be established in accordance with 10 CFR 431.

Table C405.8 (4)
Minimum Average Full Load Efficiency for Capacitor-Start Capacitor-Run and Capacitor-Start Induction-Run *Small Electric Motors*[a]

Open Motors			
Number of Poles ==>	**2**	**4**	**6**
Synchronous Speed (RPM)	**3600**	**1800**	**1200**
Motor Horsepower			
0.25	**66.6**	**68.5**	**62.2**
0.33	**70.5**	**72.4**	**66.6**
0.50	**72.4**	**76.2**	**76.2**
0.75	**76.2**	**81.8**	**80.2**
1	**80.4**	**82.6**	**81.1**
1.5	**81.5**	**83.8**	**N/A**
2	**82.9**	**84.5**	**N/A**
3	**84.1**	**N/A**	**N/A**

[a] Average full load efficiencies shall be established in accordance with 10 CFR 431.

Add new definitions as follows:

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE I): A motor which is designed in standard ratings with either:

1. Standard operating characteristics and standard mechanical construction for use under usual service conditions, such as those specified in NEMA MG1, paragraph 14.02, “Usual Service Conditions,” and without restriction to a particular application or type of application; or

2. Standard operating characteristics or standard mechanical construction for use under unusual service conditions, such as those specified in NEMA MG1, paragraph 14.03, “Unusual Service Conditions,” or for a particular type of application, and which can be used in most general purpose applications.

General purpose electric motors (subtype I) are constructed in NEMA T-frame sizes, or IEC metric equivalent, starting at 143T.

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE II). A motor incorporating the design elements of a general purpose electric motor (subtype I) that is configured as one of the following:

1. A U-frame motor
2. A Design C motor
3. A close-coupled pump motor
4. A footless motor
5. A vertical, solid-shaft, normal-thrust motor (as tested in a horizontal configuration)
6. An 8-pole motor (900 rpm)
7. A polyphase motor with voltage of not more than 600 volts (other than 230 or 460 volts)

SMALL ELECTRIC MOTOR. A general purpose, alternating current, single speed induction motor.

Add new standard to Chapter 5 as follows:

DOE

10 CFR 431 Subpart B, App B, Uniform Test Method for Measuring Nominal Full Load Efficiency of Electric Motors.

NEMA National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

MG1-2011 Motors and Generators.

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised with respect to electric motor efficiency provisions, an issue not currently addressed in the IECC Commercial Provisions. The change ensures continued consistency between the IECC and standard 90.1-2010 and addresses an important component associated with improving building energy efficiency.

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

CE331-13

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

C405.8-EC-FERGUSON.doc

CE332 – 13
C405.8 (NEW), C405.8.1 (NEW)

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD)

Add new text as follows:

C405.8 Variable speed escalators and moving walks. Escalators and moving walks shall be capable of reducing their operating speed to no more than 15 feet per minute when no passengers have been detected for a period of time not exceeding three times the amount of time required to transfer a passenger between landings.

> **Exception:** A power factor controller that reduces operating voltage in response to light loading conditions is permitted to be provided in place of the variable speed function.

C405.8.1 Regenerative drive. An escalator designed either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded with passengers whose combined weight exceeds 750 pounds.

Reason: This proposal will result in reduced energy use and longer equipment life due to reduced wear and tear during the hours on standby mode or light loading conditions. These escalator controls have been standard in Canada, Europe and most of Asia for many years. The 2010 ANSI/ASME A17.1 safety standard for elevators and escalators now allows use of escalators and moving walks with "sleep mode" for reducing speed during unoccupied periods and provides for their safe operation. Sensors detect approaching passengers and bring the escalator or walk up to full speed before the passenger steps on. The 750-pound threshold for activation of the regenerative drive is derived from the 5-passenger threshold mentioned in manufacturers' literature (5 passengers x 150# = 750).

Energy savings:

The energy consumed by a typical pair of escalators is approximately 24,000 – 36,000 kWh per year, and the predicted energy savings ranges between 25% and 60%. The higher figure applies to escalators that have bursts of usage at wide intervals, as occurs with performing arts or transportation facilities. The lower figure would apply where usage is scattered throughout the day, as in shopping malls or office buildings. Annual savings per pair of escalators would equate to an energy cost savings of $600 - $2,140. The installed cost of escalators would typically increase by 1% - 4%, although one major manufacturer now includes these capabilities as standard for all escalators.

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

CE332-13

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

C405.8-EC-KRANZ.doc

CE333 – 13
C405 (NEW), C405.1 (NEW), C405.2 (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C405 Vertical and horizontal transportation systems and equipment. Vertical and horizontal transportation systems and equipment shall comply with this section.

C405.1 Elevator cabs. For the luminaires in each elevator cab, not including signals and displays, the sum of the lumens divided by the sum of the watts shall be no less than 35 lumens per watt. Ventilation fans in elevators that do not have their own air conditioning system shall not consume more than 0.33 watts/cfm at the maximum rated speed of the fan. Controls shall be provided that will de-energize ventilation fans and lighting systems when the elevator is stopped, unoccupied and with its doors closed for over 15 minutes.

C405.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

Add new standard to Chapter 5 as follows:

ASME

ASME/A17.1/CSA B44-2010 Safety Code for Elevators and Escalators

Reason: Energy is used in lighting and ventilating elevators when in operation and when not in operation. ASHRAE/IES Standard 90.1-2010, which is adopted by reference in the IECC Commercial Provisions, contains provisions to reduce the amount of energy used by elevators. This change ensures consistency between the IECC Commercial Provisions and standard 90.1 and owners/developers who choose to comply with standard 90.1 via the IECC are afforded this opportunity to save energy and reduce their operating costs.

Cost Impact: The code change proposal will increase the cost of construction if controls for ventilation on fans and systems are required.

CE333-13

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

C405 (NEW) #1-EC-FERGUSON.doc

CE334 – 13
C405 (NEW), Chapter 5

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C405 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have the capability to automatically reduce to the minimum permitted speed in ASME A17.1/CSA B44 when not conveying passengers.

Add new standard to Chapter 5 as follows:

ASME

ASME/A17.1/CSA B44-2010 Safety Code for Elevators and Escalators

Reason: ASHRAE/IES Standard 90.1-2010, which is adopted by reference as an alternative to the IECC Commercial Provisions, has been revised to address energy efficiency opportunities available through automatic reduction in rate of travel when not being used. The change ensures continued consistency between the IECC and standard 90.1-2010 and through reference to ASME A17.1/CSA B44, which is adopted by reference in the IBC, ensures consistency within the ICC International Codes.

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

CE334-13

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

C405 (NEW) #2-EC-FERGUSON.doc

CE335 – 13
C406.1, C406.2, C406.3, C406.3.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C406.1 Requirements. Buildings shall comply with at least one of the following:

1. More efficient HVAC equipment ~~performance~~ in accordance with Section C406.2.
2. Reduced ~~efficient~~ lighting power density ~~system~~ in accordance with Section C406.3.
3. On-site supply of renewable energy in accordance with Section C406.4.

C406.2 More efficient HVAC ~~performance~~ equipment. Equipment shall meet the minimum efficiency requirements of Tables C406.2.(1) through C406.2(7) in addition to the requirements in Section C403. This section shall only be used where the equipment efficiencies in Tables C406.2(1) through C406.2(7) are greater than the equipment efficiencies listed in Table C403.2.3(1) through 403.2.3(7) for the equipment type.

C406.3 ~~Efficient lighting system~~ Reduced lighting power density. ~~Whole building lighting power density (Watts/sf) shall comply with the requirements of Section C406.3.1.~~

~~C406.3.1 Reduced lighting power density.~~ The total interior lighting power (watts) of the building shall ~~be determined~~ not exceed ~~by using the reduced whole building interior lighting power in~~ the sum of the results from multiplying the appropriate values in Table C406.3 ~~times~~ by the floor area for ~~the~~ each building area type~~s~~. For the purposes of this option the determination of areas and their application to each building type shall be in accordance with Section C405.5.2.

Reason: This proposal simplifies and clarifies the provisions associated with additional energy efficiency options packages. The objective of this proposal is to clarify and simplify the code to foster implementation and compliance verification.
The intent of the HVAC package option is to install more efficient HVAC equipment than provided for in the minimum code. The intent of the lighting package option is to reduce the allowable LPD in Table C405.5.2(1) by a set amount. The proposed revisions convey more clearly what is intended. There are provisions in Section C405.5.2 affecting the calculation that still apply and should be referenced to ensure the code is consistent between the base code and this package option with respect to how the floor area for each building or building type is determined and applied.

Cost Impact: The code change proposal will not increase the cost of construction.

CE335-13

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

C406.1-EC-WILLIAMS.doc

CE336 – 13
C406.1.1 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

SECTION C406
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

C406.1 Requirements. Buildings shall comply with at least one of the following:

1. Efficient HVAC Performance in accordance with Section C406.2.
2. Efficient Lighting System in accordance with Section C406.3.
3. On-Site Supply of Renewable Energy in accordance with Section C406.4.

<u>**C406.1.1. Tenant spaces.** Except where an entire building is in compliance with Section C406.4,</u> individual tenant spaces shall comply with either Section C406.2 or Section C406.3. ~~unless documentation can be provided that demonstrates compliance with Section C406.4 for the entire building~~

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The proposal is a reformat of the second paragraph to clarify how it should be applied. The phrasing 'unless documentation can be provided that demonstrates compliance' is unnecessary language within an International Code. Such phrases are redundant with the purposes and intent of Chapter C1 – Administration. All code compliance is documented by submitted plans and inspections. The intent of this section is to allow tenant spaces to be evaluated or approved on a space by space basis unless the building has already found to comply.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE336-13

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

C406.1.1 (NEW)-EC-THOMPSON-SEHPCAC

CE337 – 13

C202 (NEW), C406.1, C406.2, Table C406.2(1), Table C406.2(2), Table C406.2(3), Table C406.2(4), Table C406.2(5), Table C406.2(6), Table C406.2(7), C406.3, C406.4, C406.5 (NEW), C406.6 (NEW), C406.8 (NEW), C406.8.1 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com), Jim Edelson, New Buildings Institute

Revise as follows:

C406.1 Requirements. Buildings shall comply with at least one of the following:

1. More efficient HVAC equipment ~~performance~~ in accordance with Section C406.2.
2. Reduced ~~efficient~~ lighting power density system in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High efficiency service water heating in accordance with Section C406.8.

C406.2. More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.2.3(1) through 403.2.3(7) by 10 percent in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 by 10 percent. Equipment not listed in Tables C403.2.3(1) through 403.2.3(7) shall be limited to 10 percent of the total building system capacity.

~~TABLE C406.2(1)~~
~~UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~[a]	
			~~CLIMATE ZONES 1 - 5~~	~~CLIMATE ZONES 6 - 8~~
~~Air conditioners, air cooled~~	~~< 65,000 Btu/h~~	~~Split system~~	~~15.0 SEER~~ ~~12.5 EER~~	~~14 SEER~~ ~~12 EER~~
		~~Single package~~	~~15.0 SEER~~ ~~12.0 EER~~	~~14.0 SEER~~ ~~11.6 EER~~
	~~≥ 65,000 Btuh/h and < 240,000 Btu/h~~	~~Split system and single package~~	~~12.0 EER~~[b] ~~12.54 IEER~~[b]	~~11.5 EER~~[b] ~~12.0 IEER~~[b]
	~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Split system and single package~~	~~10.8 EER~~[b] ~~11.3 IEER~~[b]	~~10.5 EER~~[b] ~~11.0 IEER~~[b]
	~~≥ 760,000 Btu/h~~	—	~~10.2 EER~~[b] ~~10.7 IEER~~[b]	~~9.7 EER~~[b] ~~10.2 IEER~~[b]
~~Air conditioners, water and evaporatively cooled~~	—	~~Split system and single package~~	~~14.0 EER~~	~~14.0 EER~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~
~~a. IEERs are only applicable to equipment with capacity modulation.~~
~~b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.~~

~~TABLE C406.2(2)~~
~~UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY[a]~~	
			~~CLIMATE ZONES 1 - 5~~	~~CLIMATE ZONES 6 - 8~~
~~Air cooled (Cooling mode)~~	~~< 65,000 Btu/h~~	~~Split system~~	~~15.0 SEER, 12.5 EER~~	~~14.0 SEER, 12.0 EER~~
		~~Single package~~	~~15.0 SEER, 12.0 EER~~	~~14.0 SEER 11.6 EER~~
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~Split system and single package~~	~~12.0 SEER, 12.4 EER~~	~~11.5 EER[b], 12.0 IEER[b]~~
	~~≥ 240,000 Btu/h~~	~~Split system and single package~~	~~12.0 SEER, 12.4 EER~~	~~10.5 EER[b], 10.5 IEER[b]~~
~~Water sources (Cooling mode)~~	~~< 135,000 Btu/h~~	~~85°F entering water~~	~~14.0 EER~~	~~14.0 EER~~
~~Air cooled (Heating mode)~~	~~< 65,000 Btu/h (Cooling capacity)~~	~~Split system~~	~~9.0 HSPF~~	~~8.5 HSPF~~
		~~Single package~~	~~8.5 HSPF~~	~~8.0 HSPF~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)~~	~~47°F db/43°F wb outdoor air~~	~~3.4 COP~~	~~3.4 COP~~
		~~17°F db/15°F wb outdoor air~~	~~2.4 COP~~	~~2.4 COP~~
	~~≥ 135,000 Btu/h (Cooling capacity)~~	~~47°F db/43°F wb outdoor air~~	~~3.2 COP~~	~~3.2 COP~~
		~~77°F db/15°F wb outdoor air~~	~~2.1 COP~~	~~2.1 COP~~
~~Water sources (Heating mode)~~	~~< 135,000 Btu/h (Cooling capacity)~~	~~70°F entering water~~	~~4.6 COP~~	~~4.6 COP~~

~~For SI: °C = [(°F) - 32] / 1.8, 1 British thermal unit per hour = 0.2931 W.~~
~~db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F.~~
~~a. IEERs and Part load rating conditions are only applicable to equipment with capacity modulation.~~
~~b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.~~

~~TABLE C406.2(3)~~
~~PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINALHEAT PUMPS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~MINIMUM EFFICIENCY~~
~~Air conditioners and heat pumps (cooling mode)~~	~~< 7,000 Btu/h~~	~~11.9 EER~~
	~~7,000 Btu/h and < 10,000 Btu/h~~	~~11.3 EER~~
	~~10,000 Btu/h and ≤ 13,000 Btu/h~~	~~10.7 EER~~
	~~> 13,000 Btu/h~~	~~9.5 EER~~

~~TABLE C406.2(4)~~
~~WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY (INPUT)~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~
~~Warm air furnaces, gas fired~~[a]	~~< 225,000 Btu/h~~	—	~~For Climate Zones 1 and 2 NR~~	~~DOE 10 CFR Part 430 or ANSI Z21.47~~
			~~For Climate Zones 3 and 4 90 AFUE or 90~~ ~~E_t~~[c]	
			~~For Climate Zones 4 – 8 92 AFUE or 92~~ ~~E_t~~[c]	
	~~≥ 225,000 Btu/h~~	~~Maximum capacity~~	~~90%~~ ~~E_c~~[b]	~~ANSI Z21.47~~
~~Warm air furnaces, oil fired~~[a]	~~< 225,000 Btu/h~~	—	~~For Climate Zones 1 and 2 NR~~	~~DOE 10 CFR Part 430 or UL 727~~
			~~For Climate Zones 3 – 8 85 AFUE or 85~~ ~~E_t~~[c]	
	~~≥ 225,000 Btu/h~~	~~Maximum capacity~~	~~85%~~ ~~E_t~~[b]	~~UL 727~~
~~Warm air duct furnaces, gas fired~~[a]	~~All capacities~~	~~Maximum capacity~~	~~90%~~ ~~E_c~~	~~ANSI Z83.8~~
~~Warm air unit heaters, gas fired~~	~~All capacities~~	~~Maximum capacity~~	~~90%~~ ~~E_c~~	~~ANSI Z83.8~~
~~Warm air unit heaters, oil fired~~	~~All capacities~~	~~Maximum capacity~~	~~90%~~ ~~E_c~~	~~UL 731~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~E_t = Thermal efficiency. E_c = Combustion efficiency (100 percent less flue losses).~~

~~a. Efficient furnace fan: Fossil fuel furnaces in climate zones 3 to 8 shall have a furnace electricity ratio not greater than 2 percent and shall include a manufacturer's designation of the furnace electricity ratio.~~

~~b. Units shall also include an IID (intermittent ignition device), have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~

~~c. Where there are two ratings for units not covered by NAECA (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]), units shall be permitted to comply with either rating.~~

~~TABLE C406.2(5)~~
~~BOILER, EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~FUEL~~	~~SIZE CATEGORY~~	~~TEST PROCEEDURE~~	~~MINIMUM EFFICIENCY~~
~~Steam~~	~~Gas~~	~~< 300,000 Btu/h~~	~~DOE 10 CFR Part 430~~	~~83% AFUE~~
		~~> 300,000 Btu / h and > 2.5 m Btu/h~~	~~DOE 10 CFR Part 431~~	~~81%~~ ~~E_t~~
		~~>2.5 m Btu/h~~		~~82%~~ ~~E_c~~
	~~Oil~~	~~< 300,000 Btu/h~~	~~DOE 10 CFR Part 430~~	~~85% AFUE~~
		~~> 300,000 Btu/h and > 2.5 m Btu/h~~	~~DOE 10 CFR Part 431~~	~~83%~~ ~~E_t~~
		~~>2.5 m Btu/h~~		~~84%~~ ~~E_c~~
~~Hot water~~	~~Gas~~	~~< 300,000 Btu/h~~	~~DOE 10 CFR Part 430~~	~~97% AFUE~~
		~~> 300,000 Btu/h and > 2.5 m Btu/h~~	~~DOE 10 CFR Part 431~~	~~97%~~ ~~E_t~~
		~~>2.5 m Btu/h~~		~~94%~~ ~~E_c~~

	~~Oil~~	~~< 300,000 Btu/h~~	~~DOE 10 CFR Part 430~~	~~90% AFUE~~
		~~> 300,000 Btu/h and > 2.5 m Btu/h~~	~~DOE 10 CFR Part 431~~	~~88% E_t~~
		~~>2.5 m Btu/h~~		~~87% E_c~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~E_t = Thermal efficiency. E_c = Combustion efficiency (100 percent less flue losses).~~

~~TABLE C406.2(6)~~
~~CHILLERS—EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~UNITS~~	~~MINIMUM EFFICIENCY[a] (I-P)~~				~~Test Procedure[b]~~
			~~Path A~~		~~Path B[c]~~		
			~~Full Load~~	~~IPLV~~	~~Full Load~~	~~IPLV~~	
~~Air-cooled chillers with condenser, electrically operated~~	~~< 150 tons~~	~~EER~~	~~10.000~~	~~12.500~~	~~NA~~	~~NA~~	~~AHRI 550/590[f]~~
	~~≥ 150 tons~~	~~EER~~	~~10.000~~	~~12.750~~	~~NA~~	~~NA~~	
~~Air-cooled without condenser, electrical operated~~	~~All capacities~~	~~EER~~	~~Condenserless units shall be rated with matched condensers~~				~~AHRI 550/590[f]~~
~~Water-cooled, electrically operated, positive displacement (reciprocating)~~	~~All capacities~~	~~kw/ton~~	~~Reciprocating units required to comply with water cooled positive displacement requirements~~				~~AHRI 550/590[f]~~
~~Water-cooled electrically operated, positive displacement~~	~~< 75 tons~~	~~kw/ton~~	~~0.780~~	~~0.630~~	~~0.800~~	~~0.600~~	~~AHRI 550/590[f]~~
	~~≥ 75 tons and < 150 tons~~	~~kw/ton~~	~~0.775~~	~~0.615~~	~~0.790~~	~~0.586~~	
	~~≥ 150 tons and < 300 tons~~	~~kw/ton~~	~~0.680~~	~~0.580~~	~~0.718~~	~~0.540~~	
	~~≥ 300 tons~~	~~kw/ton~~	~~0.620~~	~~0.540~~	~~0.639~~	~~0.490~~	
~~Water-cooled electrically operated, centrifugal[d]~~	~~< 150 tons~~	~~kw/ton~~	~~0.634~~	~~0.596~~	~~0.639~~	~~0.450~~	~~AHRI 550/590[f]~~
	~~≥ 150 tons and < 300 tons~~	~~kw/ton~~	~~0.634~~	~~0.596~~	~~0.639~~	~~0.450~~	
	~~≥ 300 tons and < 600 tons~~	~~kw/ton~~	~~0.576~~	~~0.549~~	~~0.600~~	~~0.400~~	
	~~≥ 600 tons~~	~~kw/ton~~	~~0.570~~	~~0.539~~	~~0.590~~	~~0.400~~	
~~Air-cooled absorption single effect[e]~~	~~All capacities~~	~~COP~~	~~0.600~~	~~NR~~	~~NA~~	~~NA~~	~~AHRI 560~~
~~Water-cooled absorption single effect[e]~~	~~All capacities~~	~~COP~~	~~0.700~~	~~NR~~	~~NA~~	~~NA~~	
~~Absorption double effect indirect-fired~~	~~All capacities~~	~~COP~~	~~1.000~~	~~1.050~~	~~NA~~	~~NA~~	
~~Absorption double effect direct fired~~	~~All capacities~~	~~COP~~	~~1.000~~	~~1.000~~	~~NA~~	~~NA~~	

~~For SI: 1 Ton = 3516 W.~~

~~NA = Not applicable and cannot be used for compliance. NR = No minimum requirements.~~

~~a. Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However both the full load and IPLV shall be met to fulfill the requirements of Path A and Path B.~~

~~b. Chapter 6 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~

~~c. Path B is intended for applications with significant operating time at part load. All Path B machines shall be equipped with demand limiting capable controls.~~

~~d. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is greater than 40°F.~~

~~e. Only allowed to be used in heat recovery applications.~~

~~f. Packages that are not designed for operation at ARI Standard 550/590 test conditions (and, thus, cannot be tested to meet the requirements of Table C-3) of 44°F leaving chilled-water temperature and 85°F entering condenser-water temperature with 3 gpm/ton condenser-water flow shall have maximum full-load kW/ton and *NPLV* ratings adjusted using the following equation:~~

~~Adjusted maximum full load kW/ton rating = (full load kW/ton from Table C-3)/K_{adj}~~

~~Adjusted maximum NPLV rating = (IPLV from Table C-3)/K_{adj}~~

~~where:~~

~~K_{adj} = 6.174722 – 0.303668(X) + 0.00629466(X)^2 – 0.000045780(X)^3~~
~~X = DT_{std} + LIFT (°F)~~
~~DT_{std} = [(24 + (full load kW/ton from Table C-3) × 6.83)]/flow (°F)~~
~~Flow = condenser-water flow (gpm) / cooling full load capacity (tons)~~
~~LIFT = CEWT – CLWT (°F)~~
~~CEWT = full load entering condenser-water temperature (°F)~~
~~CLWT = full load leaving chilled-water temperature (°F)~~

~~The adjusted full load and *NPLV* values are only applicable over the following full-load design ranges:~~
~~Minimum leaving chilled-water temperature: 38°F~~
~~Maximum condenser entering water temperature: 102°F~~
~~Condenser-water flow: 1 to 6 gpm/ton~~
~~X ≥ 39°F and ≤60°F~~

~~TABLE C406.2(7)~~
~~ABSORPTION CHILLERS—EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~MINIMUM EFFICIENCY FULL LOAD COP (IPLV)~~
~~Air cooled, single effect~~	~~0.60, allowed only in heat recovery applications~~
~~Water cooled, single effect~~	~~0.70, allowed only in heat recovery applications~~
~~Double effect – direct fired~~	~~1.0 (1.05)~~
~~Double effect – indirect fired~~	~~1.20~~

C406.3 Reduced lighting power density The total interior lighting power (watts) of the building shall be determined by using 90 percent of the lighting power values in Table C405.5.2(1)~~the reduced whole building interior lighting power in Table C406.3~~ times the floor area of the building types~~.~~ or by using 90 percent of the interior lighting power allowance calculated by the Space by Space method in section C405.5.2.

C406.4 Enhanced digital lighting controls. Interior lighting in the building shall have the following enhanced lighting controls which shall be located, scheduled, and operated in accordance with Section C405.2.2.

1. Luminaires shall be capable of continuous dimming.
2. Luminaires shall be capable of being addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of no more than 4 luminaries shall be allowed.
3. No more than 8 luminaires shall be controlled together in a *daylight zone*
4. Fixtures shall be controlled through a digital control system that includes the following function:
   1.1. Control reconfiguration based on digital addressability
   1.2. Load shedding
   1.3. Individual user control of overhead general illumination in open offices
   1.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.
5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4 of Section C406.4.
6. Functional testing of lighting controls shall comply with Section 408.

~~C406.4~~ C406.5 On-site renewable energy Total minimum ratings of on-site renewable energy systems shall comply with one of the following:

1. Provide not less than 1.75 btu's, or not less than 0.50 watts, per square foot of conditioned floor area.

2. Provide not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4;

C406.6 Dedicated outdoor air system. Buildings covered by Section C403.4 shall be equipped with an independent ventilation system designed to provide no less than the minimum 100 percent outdoor air to each individual occupied space as specified by the *International Mechanical Code*, to each individual occupied space. The ventilation system shall be capable of total energy recovery. The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall reset the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

C406.7 Reduced energy use in service water heating. Buildings shall be of the following types to use this compliance method:

1. Group R-1, Boarding houses, Hotels or motels;
2. Group I-2, Hospitals, mental hospitals, and nursing homes;
3. Group A-2, Restaurants and Banquet halls or buildings containing food preparation areas;
4. Group F, Laundries;
5. Group R-2 Buildings with residential occupancies;
6. Group A-3 Health clubs and spas; or
7. Buildings showing a service hot water load of 10 percent or more of total building energy loads as shown with an energy analysis as described in Section C407.

C406.7.1 Load fraction. The building service water heating system shall have one or more of the following that are sized to provide at least 60 percent of hot water requirements, or sized to provide 100 percent of hot water requirements if the building must otherwise comply with Section C403.4.6:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or a combined heat and power system.
2. Solar water heating systems.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

VARIABLE REFRIGERANT FLOW SYSTEM. An engineered direct expansion (DX) refrigerant system that incorporates a common condensing unit, at least one variable capacity compressor, a distributed refrigerant piping network to multiple indoor fan heating and cooling units each capable of individual zone temperature control, through integral zone temperature control devices and common communications network. Variable refrigerant flow utilizes three or more steps of control on common inter-connecting piping.

Reason: This proposal increases the number of optional packages in the IECC from three to six for compliance with Section C406, in addition to the modeling options available both in Section 507 of the IECC and the Energy Cost Budget method of ASHRAE 90.1. The purpose of this section is to provide flexibility for compliance, and to recognize that all buildings may not be able to meet higher levels of efficiency in today's prescriptive model codes without providing options. The specifications included in the six approximately equal energy packages were based on preliminary modeling done by New Buildings Institute.

HVAC

The equipment tables have been removed and replaced with a requirement for a 10% increase in efficiency over the base requirements. This will ensure that the HVAC equipment efficiency levels contained in this section provide the necessary energy savings over equipment efficiencies contained in Section C403. This will allow the base efficiencies to be increased in future code cycles without needing to make corresponding changes to Section C406. The proposed option limits the use of heating and cooling equipment not listed in the C403 tables to no more than 10% of the total building capacity. This would allow some systems, e.g. electric resistance heat, to be used in a limited capacity for the proposed project and still allow the code user to use this option. Under the 2012 IECC all systems must comply with the equipment efficiency requirements.

LPD

The LPD tables have been removed and replaced with a requirement for a 10% increase in efficiency over the base requirements for whole building or space-by-space. This will ensure that the LPD levels contained in this section provide the necessary energy savings over the LPDs contained in Section C405. This will allow the base efficiencies to be increased in future code cycles without needing to make corresponding changes to Section C406. The 2012 IECC Additional Package Options only allowed whole building LPDs to be used. This proposal allows the use of space-by-space LPDs to provide more flexibility to the code user thereby increasing the viability of this option. The values proposed in this section are similar to those included as part of ASHRAE Standard 189.1.

The renewable option has not been modified from the 2012 IECC and provides three straightforward compliance approaches: electricity generation, thermal collection, and a calculation method for any type or combination of energy production. A path to include purchase of renewable power or credits was carefully considered, but not included based on concerns regarding verification and permanence of the transaction after the certificate of occupancy has been issued.

The Dedicated Outdoor Air System package is based on technical specifications from the 50% Technical Support Documents of the Pacific Northwest National Lab. The measure requires that adequate quantity of outside air is delivered separately to spaces in the buildings while employing 100% energy recovery. This reduces the need for excess outdoor air or supply air, and uses less energy for terminal reheating.

The Enhanced Lighting Controls Package provides a non-LPD lighting alternative package requires a digital control system to allow continuous dimming and a significant level of controllability on individual luminaires, or groups of no more than eight luminaires.

The Service Water Heating Package language is modified from similar language in the IgCC and the 2012 North Carolina commercial code. The requirements for use of waste energy to heat service hot water are in excess of what is otherwise required in Section C403 of the IECC, when applicable. Solar thermal water heating systems may also be used. This package is independent of the package offered in Section C406.5 since only one package is required for compliance with Section 406 in total.

Cost Impact: The code change proposal will not increase the cost of construction.

CE337-13

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

C406.1-EC-EDELSON-MAKELA.doc

CE338 – 13
Table C406.2(5)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C406.2(5)
BOILER EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	FUEL	SIZE CATEGORY	TEST PROCEEDURE	MINIMUM EFFICIENCY
Steam	Gas	< 300,000 Btu/h	DOE 10 CFR Part 430	83% AFUE
		> 300,000 Btu/h and > 2.5 m Btu/h	DOE 10 CFR Part 431	81% E_t
		>2.5 m Btu/h		82% E_c
	Oil	< 300,000 Btu/h	DOE 10 CFR Part 430	85% AFUE
		> 300,000 Btu/h and > 2.5 m Btu/h	DOE 10 CFR Part 431	83% E_t
		>2.5 m Btu/h		84% E_c
Hot water	Gas	< 300,000 Btu/h	DOE 10 CFR Part 430	~~97%~~ 94% AFUE
		> 300,000 Btu/h and > 2.5 m Btu/h	DOE 10 CFR Part 431	~~97%~~ 89% E_t
		>2.5 m Btu/h		~~94%~~ 91% E_c
	Oil	< 300,000 Btu/h	DOE 10 CFR Part 430	90% AFUE
		> 300,000 Btu/h and > 2.5 m Btu/h	DOE 10 CFR Part 431	88% E_t
		>2.5 m Btu/h		87% E_c

For SI: 1 British thermal unit per hour = 0.2931 W.
E_t = Thermal efficiency. E_c= Combustion efficiency (100 percent less flue losses).

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:
This table was originally intended to match the State of Massachusetts Stretch Code values. State of Massachusetts modified their boiler figures below even the AEDG levels due to push-back and local study. MA. went with ASHRAE 189.1 levels. State of NY is following this same path and using the MA. efficiency figures for their adoption of 2012 IECC.

This proposal does not reduce the intended efficiency levels for Section 406: the levels will remain at least 10% over the current federal minimum efficiency standards through 2018.

There are no updates at the EERE or ASHRAE web sites available to show that federal minimum efficiency levels will change for this equipment prior to the release of the 2018 IECC. Some sources point to possible updates in 2020 for some boiler types, but unable to confirm at EERE (US DOE) or via Federal Register. Unlike residential furnaces (effective May 1, 2013), residential (under 300 MBH) boilers efficiencies were not updated in the latest ASHRAE 90.1

The proposal is to correct the tables to a useable and adoptable set of figures. Boiler efficiencies raise nearly 20% above federal minimums. Intent of Section C406 was for an average 10% efficiency increase. Gas-fired hot water boilers singled out for much higher efficiency improvement than oil-fired or steam boilers.

Boilers at these efficiencies are nearly non-existent. The I-B-R listed equipment can be found at the following link (http://www.ahridirectory.org/ahridirectory/pages/cblr/defaultSearch.aspx) and the table can list all units by efficiency. An Excel file with efficiencies can be exported for review. Old I=B=R certification listings no longer available at AHRI web site. (Can furnish as an attachment).

NOTATION TO INCLUDED DOCUMENTS:

- I=B=R listing & Massachusetts Stretch code supplement.
- For the 97% AFUE, there are only 7 boilers manufactured listed at this efficiency, by only 5 manufacturers that can prove efficiency (Energy Star). Need to list standard for testing/proof of ratings: big issue with "claims" of efficiency. http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=BO
- For 97% E_t , there are only the following (I=B=R certified product directory; nothing new from AHRI/GAMA):
    - 1 Buderus unit (not the series of boilers)
    - 1 RayPak model series
    - RBI: One unit (not the series of boilers)
    - Viessman: 5 of 6 units
- For 94% $E_{c,}$ Large units >2.5 Million: Only two manufacturers
    - 1 Buderus model line (3 sizes)
    - 1 Viessmann model line (many sizes)

Cost Impact: The change will not increase the cost of construction, but may reduce it by making more equipment available to meet the requirement.

CE338-13

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

C406.2(5)T-EC-THOMPSON-SEHPCAC

CE339 – 13
C406.2, Table C406.2(7)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C406.2 Efficient HVAC performance. Equipment shall meet the minimum efficiency requirements of Tables C406.2(1) through ~~C406.2(7)~~ C406.2(6) in addition to the requirements in Section C403. This section shall only be used where the equipment efficiencies in Tables C406.2(1) through ~~C406.2(7)~~ C406.2(6) are greater than the equipment efficiencies listed in Table C403.2.3(1) through ~~403.2.3(7)~~ 403.2.3(6) for the equipment type.

~~TABLE C406.2(7)~~
~~ABSORPTION CHILLERS EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~MINIMUM EFFICIENCY FULL LOAD COP (IPLV)~~
~~Air cooled, single effect~~	~~0.60, allowed only in heat recovery applications~~
~~Water cooled, single effect~~	~~0.70, allowed only in heat recovery applications~~
~~Double effect - direct fired~~	~~1.0 (1.05)~~
~~Double effect - indirect fired~~	~~1.20~~

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

Reasons for this specific proposal:

Absorption chillers for air cooled, single effect and water cooled, single effect, absorption double effect indirect fired, and absorption double effect direct fired are listed in both Tables C406.2(6) and C406.2(7). The data is the same in the tables except for double effect- indirect fired minimum efficiency full load COP (IPLV) requirements. The data shown in Table C406.2(6) is correct and agrees with ASHRAE 90.1. Delete Table C406.2(7) as data is in Table C406.2(6). Revise Section C406.2 as it references Table C406.2(7) and it is deleted. This will resolve the overlap in the two tables regulating 'absorption chillers.'

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will have no impact on the cost of construction.

CE339-13

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

C406.2(7)T-EC-THOMPSON-SEHPCAC

CE340 – 13
C406.3, Table C406.3, C406.3.1

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glen@lampartners.com)

Revise as follows:

C406.3 ~~**Efficient lighting system.** Whole building lighting power density (Watts/sf) shall comply with the requirements of Section C406.3.1.~~ <u>**Reduced lighting power density.** The lighting power allowance shall be 90 percent of the lighting power allowance determined according to Section C405.5.2.</u>

~~**C406.3.1 Reduced lighting power density.** The total interior lighting power (watts) of the building shall be determined by using the reduced whole building interior lighting power in Table C406.3 times the floor area for the building types.~~

~~TABLE C406.3~~
~~REDUCED INTERIOR LIGHTING POWER~~

Reason: Simplify and clarify the code. Allow proper design flexibility without reducing stringency.
As currently written, this option only allows the use of Building Area Method lighting power densities according to the values in table C406.3, which are 10% below base code. This prevents the designer from using the space-by-space method to determine the lighting power allowance for this additional efficiency option. This proposal simply requires a 10% reduction in the lighting power from what is allowed in base code. It does not change stringency and it simplifies the code. Also it means that whenever the base code LPD values are updated, no changes to this option will need to be made. No table will need to be revised.

Cost Impact: The code change proposal will not increase the cost of construction.

CE340-13

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

C406.3-EC-HEINMILLER.doc

CE341 – 13
C406.3.1

Proponent: David Handwork, Arkansas State University

Revise as follows:

C406.3.1 Reduced lighting power density. The total interior lighting power (watts) of the building shall be determined by using the reduced whole building interior lighting power in Table C406.3 times the floor area for the building types. <u>Conversion of existing spaces to lighting power densities recommended in Table 406.6 shall be permitted to follow a program acceptable to the authority having jurisdiction.</u>

Reason: While a supporter of all practical energy conservation concepts, the education facilities industry needs to see scalable conformity options as bright line language in this code.

Cost Impact: This code change proposal will not increase the cost of construction. Granting Owners more scalable options regarding lighting retrofits generally reduces costs.

CE341-13

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

C406.3.1-EC-HANDWORK.doc

CE342 – 13
C407.2

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C407.2 Mandatory requirements. Compliance with this section requires that the criteria of Sections C402.4, C403.2, C404 and C405 be met.

<u>The permit application for projects utilizing this method shall include in one submittal all building and mechanical construction documents and all information necessary to verify that the building envelope and mechanical design for the project corresponds with the annual energy analysis. Where credit is proposed to be taken for lighting energy savings, an electrical permit application shall also be submitted and approved prior to the issuance of the permit. Where credit is proposed to be taken for energy savings from other components, construction details for those components shall be submitted with the permit application. Otherwise, components of the project that would not be approved as part of a permit application shall be modeled the same in both the proposed building and the *standard reference design* and shall comply with the requirements of this code.</u>

Reason: This proposal addresses a common problem for building officials, that various portions of the construction are submitted under different permits at different times, whereas the document review staff needs to evaluate the entire "total building performance" with all information provided.

Cost Impact: The code change proposal will not increase the cost of construction.

CE342-13

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

C407.2-EC-NOGLER.doc

CE343 – 13
C407.2, C407.2.1 (NEW)

Proponent: Brian Dean, ICC International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C407.2 Mandatory requirements. Compliance with this section requires that the criteria of Sections C402.4, C403.2, C404, ~~and~~ C405 and C407.2.1 be met.

C407.2.1 Maximum fenestration U-factor and SHGC for compliance based on total building performance (Mandatory). For buildings complying with Section C407, the area-weighted average U-factor permitted for products within each fenestration product category listed in Table C402.3 shall not exceed the applicable U-factor specified in Table C402.3 by more than 25 percent. For buildings complying with Section C407, the area-weighted average SHGC permitted for products within each fenestration product category listed Table C402.3 shall not exceed the applicable SHGC specified in Table C402.3 by more than 50 percent.

Reason: The purpose of the proposed code change is to establish new maximum trade-off limits for fenestration under the commercial performance path. This proposal imports, from the residential *IECC* provisions, an effective backstop on fenestration trade-offs that has been in the *IECC* since 2004, but with some additional modifications and improvements. This new provision will ensure that modern, highly efficient commercial buildings are required to have at least moderately efficient windows:

- New section C407.2.1 would ensure that whenever the simulated performance alternative is used, the windows on a weighted average basis will meet a reasonable level of efficiency (no worse than 25% greater U-factor and 50% greater SHGC than the prescriptive requirements).
- The main difference between this new commercial section and the existing residential trade-off backstop is that the proposed provision would cap trade-offs at a percentage of the U-factor and SHGC requirements as they change over time rather than setting specific maximum values (we are also proposing to change the residential provision to the same approach).
- This approach will allow the cap to slide up or down to match future changes to the U-factor and SHGC requirements, while still ensuring that buildings are designed and constructed with windows that fall within a reasonable range of efficiency.

The fenestration trade-off limits currently found in the residential chapter of the *IECC* are simple, mandatory measures that ensure all new buildings contain high-quality, cost-effective windows that save energy, provide reasonable comfort, resist condensation in colder climates and block unwanted solar gain in warmer climates. Without the protection of this backstop, fenestration values could be traded away to levels unacceptable in modern building practice. Given the improvements to window efficiency brought about by the 2012 IECC and our nation's high priority for energy efficiency, this proposal is a common-sense extension of an effective code requirement.

- **Simple compliance.** The residential fenestration maximums are effective and easy to understand. These requirements have been successfully applied for the last several years. All states that have already adopted the 2006, 2009, and 2012 *IECC* have adopted these maximums to residential construction. On the residential side, they are also already seamlessly built into compliance software such as the Department of Energy's REScheck. The same approach would work for commercial building compliance software.
- **Flexible standard.** The area-weighted average approach embodied in the fenestration maximums allows considerable flexibility for the use of decorative glass, glass block, and other fenestration products, while maintaining a baseline performance for the building's overall glazing. In short, not all products are required to individually meet the maximum values; only the area-weighted average of all products in the building are required to meet the maximum values specified in this code provision.
- **Quality windows, energy savings and peak demand savings nationwide**. The fenestration maximums encourage the use of cost-effective energy-efficient windows nationwide. Because good windows reduce energy consumption both during peak cooling times in the summer months and during peak heating hours in the winter months, such windows can help reduce the strain on the electric grid and natural gas pipeline system and delay the need to build expensive peaking facilities. By reducing the trade-off of efficient windows for other measures, the maximums will better capture the benefits of blocking solar gain and providing reasonable insulating value such as peak reduction, reduced cooling system sizes and year-round comfort. Consumers will also enjoy the reduced costs that come with economies of scale and market transformation.
- **More comfortable buildings and less energy use.** Incremental changes in window efficiency can have a huge impact on occupant comfort because even the most efficient windows are, at best, still only the equivalent of about an R-3 wall in the winter. Moreover, unlike the opaque wall, even the best fenestration allows substantial summer solar heat gain into

the conditioned space. Hot spots created by high solar gain in the summer and/or cold or drafty glass in the winter months can force an occupant to adjust the thermostat to compensate. A good window will provide reasonable insulating value, keeping occupants more comfortable during the coldest months. Similarly, windows with low SHGC will protect against hot spots and occupant discomfort, and will make it less likely that occupants will need to adjust the thermostat and use more energy.

For a more detailed discussion of the benefits of good fenestration, see the section on the benefits of efficient windows on the website of the Efficient Windows Collaborative -- http://www.efficientwindows.org/benefits.cfm.

The fenestration maximums have served an important role in ensuring residential energy efficiency for many years. We recommend that the fenestration maximums in the residential chapter of the *IECC* be duplicated, with the appropriate modifications, in the commercial chapter of the *IECC*.

Cost Impact: The code change proposal will not increase the cost of construction.

CE343-13

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

C407.2-EC-DEAN-HARRIS-MISURIELLO-PRINDLE-STONE-VIGNEAU.doc

CE344 – 13
C407.3.1 (NEW), Chapter 5

Proponent: Mark Nowak, M. Nowak Consulting, LLC, representing Steel Framing Alliance

Add new text as follows:

C407.3.1 Alternative to proposed design. A representative building as described in NREL/TP-5500-46861 or other representative buildings approved by the code official shall be permitted to be used in lieu of the actual building design.

Add new standard to Chapter 5 as follows:

DOE

NREL/TP-5500-46861-11 Commercial Reference Building Models of the National Building Stock

Reason: This proposal will simplify the implementation of the code by allowing a representative building to be used for compliance rather than the actual building. Designers will only need to build a model for the representative building for a given climate zone. Likewise, simulation tool developers would be able to provide the buildings in library files for users. However, it will still leave the designer the option to comply with the actual propose building.

This represents a significant deviation from past and current practice but it is a logical step for the IECC to take. Given that the representative buildings are the basis for the current prescriptive requirements, they should be permitted to be used repeatedly for building design and compliance. This approach would allow the development of multiple prescriptive solutions equivalent to those in the code without cluttering up the code with pages of additional text.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, DOE-NREL/TP-5500-46861-2011 Commercial Reference Building Models of the National Building Stock, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE344-13

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

C407.3.1 (NEW)-EC-NOWAK.doc

CE345 – 13
C407.4.1, C407.6

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C407.4.1 Compliance report. ~~Compliance software tools shall generate~~ Permit submittals shall include a report that documents that the *proposed design* has annual energy costs less than or equal to the annual energy costs of the *standard reference design.* The compliance documentation shall include the following information:

1. Address of the building;
2. An inspection checklist documenting the building component characteristics of the *proposed design* as *listed* in Table C407.5.1(1). The inspection checklist shall show the estimated annual energy consumption for both the *standard reference design* and the *proposed design;*
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

C407.6 Calculation software tools. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* and shall include the following capabilities.

~~1.~~ ~~Computer generation of the *standard reference design* using only the input for the *proposed design.* The calculation procedure shall not allow the user to directly modify the building component characteristics of the *standard reference design.*~~
~~2.~~ 1. Building operation for a full calendar year (8,760 hours).
~~3.~~ 2. Climate data for a full calendar year (8,760 hours) and shall reflect *approved* coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.
~~4.~~ 3. Ten or more thermal zones.
~~5.~~ 4. Thermal mass effects.
~~6.~~ 5. Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.
~~7.~~ 6. Part-load performance curves for mechanical equipment.
~~8.~~ 7. Capacity and efficiency correction curves for mechanical heating and cooling equipment.
~~9.~~ 8. Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table C407.5.1(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g., *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

Reason: The proposal addresses the issue that no existing software tools are capable of meeting the requirements described in this section. If the language remains as written, the Total Building Performance path cannot be used.

This correction maintains a complete performance path for compliance with the Code, which promotes innovation and flexibility in design and construction.

Cost Impact: The code change proposal will not increase the cost of construction.

CE345-13

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

C407.4.1-EC-NOGLER.doc

CE346 – 13
Table C407.5.1(1), Chapter 5

Proponent: Robert A. Zabcik, P.E., NCI Building Systems, Inc., representing Cool Metal Roofing Coalition

Revise as follows:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSAL DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Roofs	Type: Insulation entirely above deck	As proposed
	Gross Area: same as proposed	As proposed
	U-factor: from Table C402.1.2	As proposed
	~~Solar absorbance: 0.75~~ Solar Reflectance: 0.25	~~As proposed~~ three-year aged solar reflectance[e]
	Emittance: 0.90	~~As proposed~~ three-year aged thermal emittance[e]

e. Aged solar reflectance and thermal emittance shall be determined in accordance with CRRC-1.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison St
Oakland, CA 94612

CRRC-1-2012 CRRC-1 Standard

Reason: The use of initial values of solar reflectance (SR) and thermal emittance (TE) for computer modeling as opposed to three-year aged values is not representative of real-word conditions. Weathering of most roofing materials greatly changes the SR and to a lesser degree, the TE, as documented by Lawrence Berkeley and Oak Ridge National Laboratories. The California Energy Commission (CEC) Title 24 Building Energy Efficiency Standards has addressed this issue very effectively since 2005. By using 3-year aged SR and TE values, a more realistic modeling result is obtained; one that represents the performance of the roofing material during the life of the material rather than at the time of installation. The Cool Roof Rating Council (CRRC) has simultaneously developed the CRRC-1 standard to rigorously qualify the test procedures used to measure SR and TE, as well as the aging process. Thus, referencing the CRRC-1 standard is much more thorough than simply referencing the ASTM test methods used to measure SR and TE directly. The CRRC has recently been ANSI accredited to develop standards, further adding credibility. The change from solar absorbance to SR was made simply to make the nomenclature of Table C407.5.1(1) consistent with that of CRRC-1 and is based on numerical conversion; it does NOT represent a change in performance of the IECC.

It should be noted that ASHRAE made a similar change in the performance modeling requirements in Standard 90.1, Appendix G in 2010. 90.1 also provides default SR and TE values of 0.3 and 0.9 for SR and TE respectively. That approach could be taken here as well should the committee be concerned that aged data might not be readily available. However, since aged values for SR and TE are required in so many other standards nationwide, that data is generally available and there are aging formulas that modify the SR value based on curve fits. Such a formula has been used in the California Energy Commission (CEC) Building Energy Efficiency Standards since 2005.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, CRRC-1-2012 – CRRC-1 Standard, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

CE346-13

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

C407.5.1(1)T-EC-ZABCIK.doc

CE347 – 13
Table C407.5.1(1)

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.5.2 for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: Insulation entirely above deck Gross area: same as proposed *U*-factor: from Table C402.1.2 Solar absorptance: 0.75 Emittance: 0.90	As proposed As proposed As proposed As proposed As proposed
Walls, above-grade	Type: Mass wall if proposed wall is mass; otherwise steel-framed wall Gross area: same as proposed *U*-factor: from Table C402.1.2 Solar absorptance: 0.75 Emittance: 0.90	As proposed As proposed As proposed As proposed As proposed
Walls, below-grade	Type: Mass wall Gross area: same as proposed *U*-Factor: from Table C402.1.2 with insulation layer on interior side of walls	As proposed As proposed As proposed
Floors, above-grade	Type: joist/framed floor Gross area: same as proposed *U*-factor: from Table C402.1.2	As proposed As proposed As proposed
Floors, slab-on-grade	Type: Unheated *F*-factor: from Table C402.1.2	As proposed As proposed
<u>Opaque</u> Doors	Type: Swinging Area: Same as proposed *U*-factor: from Table C402.2	As proposed As proposed As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
~~Glazing~~ Vertical Fenestration other than Opaque Doors	Area 1. The proposed glazing area; where the proposed glazing area is less than 40 percent of above-grade wall area. 2. 40 percent of above-grade wall area; where the proposed glazing area is 40 percent or more of the above-grade wall area.	As proposed
	U-factor: from Table C402.3	As proposed
	SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: None	As proposed
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly. 2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly	As proposed
	U-factor: from Table C402.3	As proposed
	SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Table C405.5.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 Watt per square foot (10.73 W/m^2) based on the categorization of buildings with unknown space classification as offices.	As proposed
Lighting, exterior	The lighting power shall be determined in accordance with Table C405.6.2(2). Areas and dimensions of tradable and nontradable surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. All end-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.
Schedules	Same as proposed	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Mechanical ventilation	Same as proposed	As proposed, in accordance with Section C403.2.5.
Heating systems	Fuel type: same as proposed design	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	Equipment type[a]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(4) and C403.2.3(5)	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(1), C403.2.3(2) and C403.2.3(3)	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer[d]: same as proposed, in accordance with Section C403.4.1.	As proposed
Service water heating	Fuel type: same as proposed	As proposed
	Efficiency: from Table C404.2	As proposed
	Capacity: same as proposed	
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	As proposed

a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.

b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.

c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.

d. If an economizer is required in accordance with Table C403.3.1(1), and if no economizer exists or is specified in the proposed design, then a supply air economizer shall be provided in accordance with Section C403.4.1.

Reason: This corrects the terminology in the performance path table to be consistent with the rest of the chapter. “Doors” can include both glazed and opaque doors, but the intent was clearly meant to be opaque doors, since it is referring to only the U-factor in Table C402.2. It is then unclear where to put glazed doors. This proposal clarifies the three fenestration rows as “opaque doors”, “vertical fenestration other than opaque doors”, and “skylights”.

Cost Impact: This proposal will not increase the cost of construction.

CE347-13

Public Hearing: Committee: AS AM D

Assembly: ASF AMF DF

C407.5.1T-EC-CULP.doc

CE348 – 13
Table C407.5.1(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(1), C403.2.3(2) and C403.2.3(3)	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer[d]: same as proposed, in accordance with Section ~~C403.4.1~~ C403.3.1.	As proposed

(Portions of Table not shown remain unchanged)

a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.
b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
d. If an economizer is required in accordance with Table C403.3.1(1), and if no economizer exists or is specified in the proposed design, then a supply air economizer shall be provided in the reference design in accordance with Section ~~C403.4.1~~ C403.3.1.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

In the 2009 code this footnote refers to a section of the code that addressed supply air economizers in Complex HVAC systems. Now it refers to a section that regulates water economizers in complex HVAC systems. Unless water economizers are 'supply air economizers – the footnote is referring to a section that doesn't address the same topic. The table and footnote are corrected to show that if a building is required to have an economizer, yet the proposed design does not have an economizer, the baseline building shall be designed with an air-side economizer (not water-side). Air economizer is the baseline code. This appears to have been a modeling requirement for several code cycles: IECC and Standard 90.1 do not to allow water-side economizer as the baseline (standard reference) model when no economizer is included in the proposed design case model. If a water-side economizer is included in the proposed design, then there is a 1:1 comparison of water-side in the baseline reference and proposed design. (Please note that if SEHPCAC proposal E20A is approved this proposed change to a reference to Section C403.3.1 will also correlate with the revised provisions.)

Cost Impact: The code change proposal will not increase the cost of construction. The change is editorial in nature. It will not increase the cost of construction.

CE348-13
Public Hearing: Committee: AS AM D

Assembly: ASF AMF DF

CE349 – 13
C407.6.3 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C407.6.3 Exceptional calculation methods. When the simulation program does not model a design, material, or device of the *proposed design*, an exceptional calculation method shall be used where approved by the *code official*. Where there are multiple designs, materials, or devices that the simulation program does not model, each shall be calculated separately and exceptional savings determined for each. At no time shall the total exceptional savings constitute more than half of the difference between the baseline building performance and the proposed building performance. All applications for approval of an exceptional method shall include:

1. Step-by-step documentation of the exceptional calculation method performed detailed enough to reproduce the results;
2. Copies of all spreadsheets used to perform the calculations;
3. A sensitivity analysis of energy consumption when each of the input parameters is varied from half to double the value assumed;
4. The calculations shall be performed on a time step basis consistent with the simulation program used;
5. The performance rating calculated with and without the exceptional calculation method.

Reason: It is not unusual for the design team to want to claim credit for an energy-efficiency measure that the hourly energy analysis software is not capable of directly modeling. Consequently, designers would submit simple hand-calculations as an "add-on" to the complex calculations made by the hourly energy analysis software. This is an important challenge because it does not make sense to treat hand-calculations as comparable to those coming from sophisticated hourly energy analysis software. It is not uncommon to see designs where a single energy-efficiency measure was being proposed to make up for multiple shortfalls in the proposed design.

ASHRAE/IESNA Standard 90.1, Appendix G, Section G2.5, Exceptional Calculation Methods, has been updated and expanded in the 2010 version. The updated language from ASHRAE/IESNA Standard 90.1-2010 addresses this issue.
This will provide guidance to designers and modelers, as well as to building department staff. The result should be more consistent implementation of the annual energy analysis compliance option.

Cost Impact: The code change proposal will not increase the cost of construction.

CE349-13

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

C407.6.3 (NEW)-EC-NOGLER.doc

CE350 – 13
C408

Proponent: Richard Grace, Fairfax County Government, representing The Virginia Plumbing and Mechanical Inspectors Association, The Virginia Building Code Officials Association (Richard.Grace@fairfaxcounty.gov)

Revise as follows:

~~Section C408~~
APPENDIX A
SYSTEM COMMISSIONING

~~C408.1~~ AC 101.1 General. This ~~section~~ appendix covers the commissioning of the building mechanical systems in Section C403 and electrical power and lighting systems in Section C405.

~~C408.2~~ AC 101.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this ~~section.~~ appendix. Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this ~~section~~ appendix and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections ~~C408.2.4 and C408.2.5~~ AC101.2.4 and AC101.2.5

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units.

~~C408.2.1~~ AC 101.2.1 Commissioning plan. A *commissioning plan* shall be developed by a *registered design professional* or approved *agency* and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3. Functions to be tested, including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed. At a minimum, testing shall affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

~~C408.2.2~~ AC 101.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include air system and hydronic system balancing.

~~C408.2.2.1~~ AC 101.2.2.1 Air systems balancing. Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (0.74 kW), fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp (0.74 kW) or less.

~~**C408.2.2.2**~~ **AC 101.2.2.2** **Hydronic systems balancing.** Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions:

1. Pumps with pump motors of 5 hp (3.7 kW) or less.
2. Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

~~**C408.2.3**~~ **AC 101.2.3** **Functional performance testing.** Functional performance testing specified in Sections ~~C408.2.3.1 through C408.2.3.3~~ AC101.2.3.1 through AC101.2.3.3 shall be conducted.

~~**C408.2.3.1**~~ **AC 101.2.3.1** **Equipment.** Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

1. All modes as described in the *sequence* of *operation*;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(3) that do not require supply air economizers.

~~**C408.2.3.2**~~ **AC101.2.3.2** **Controls.** HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with *approved* plans and specifications.

~~**C408.2.3.3**~~ **AC 101.2.3.3** **Economizers.** Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

~~**C408.2.4**~~ **AC 101.2.4** **Preliminary commissioning report.** A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this ~~section~~ appendix that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

~~**C408.2.4.1**~~ **AC 101.2.4.1** **Acceptance of report.** *Buildings*, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

~~C408.2.4.2~~ AC 101.2.4.2 **Copy of report.** The *code official* shall be permitted to require that a copy of the Preliminary

~~C408.2.5~~ AC 101.2.5 **Documentation requirements.** The *construction documents* shall specify that the *documents* described in this section be provided to the *building* owner within 90 days of the date of receipt of the *certificate of occupancy*.

~~C408.2.5.1~~ AC 101.2.5.1 **Drawings.** Construction documents shall include the location and performance data on each piece of equipment.

~~C408.2.5.2~~ AC 101.2.5.2 **Manuals.** An operating and maintenance manual shall be provided and include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

~~C408.2.5.3~~ AC 101.2.5.3 **System balancing report.** A written report describing the activities and measurements completed in accordance with Section ~~C408.2.2.~~ AC 101.2.2.

~~C408.2.5.4~~ AC 101.2.5.4 **Final commissioning report.** A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

~~C408.3~~ AC 101.3 **Lighting system functional testing.** Controls for automatic lighting systems shall comply with Section ~~C408.3~~ AC101.3.

~~C408.3.1~~ AC 101.3.1 **Functional testing.** Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

Reason: We are not opposed to commissioning, in fact we fully support the concept. What we are opposed to is including language into a code that is not enforceable, inconsistent, or is written in such a way that enforcement will place a burden on building owners when occupancy permits are held up based on incomplete commissioning reports. There are many examples of this contained within this code change.

(1) C408.2 – "**Prior to passing the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion according to the provisions of this section.**" First off, this language suggests that only a registered design professional is permitted to provide such evidence, even if a licensed, Class A contractor designed the project. Second,

(2) 503.2.9.1 - "**Copies of all documentation shall be given to the owner**." We do not agree with language included in the code that requires a code official to verify contractual issues between an owner and their agents, designers, or contractors.

(3) 503.2.9.1.2 – "**All HVAC systems shall be balanced in accordance with generally accepted engineering standards**." "Shall be" is positive, enforceable language, however "generally accepted" is so open ended that consistency between any two individuals will be virtually impossible.

(4) 503.2.9.2 – "**shall not be issued a final certificate of occupancy**". This section states that a certificate of occupancy shall not be issued without receiving a letter from the owner stating that they have received the Preliminary Commissioning Report. Why should the owner of a building be penalized in such a harsh manner for a procedure that can obviously be conducted after occupancy.

(5) 503.2.9.3 – "**shall require that within 90 days after the date of final certificate of occupancy**". This section requires the code official to go back to the building owner after issuing the certificate of occupancy and verify that the building owner was provided with drawings, manuals, system balancing report, and the final commissioning report. Wow! After the certificate of occupancy is issued, the International Energy Conservation Code is no longer applicable to the building or building owner. I truly do not understand how this is going to work. What gives the code official the authority to verify and comply with this code section? What recourse does a code official have if the documentation is not provided to the building owner? Is the certificate of occupancy voided and the building occupants forced to vacate? After the certificate of occupancy is issued, the IECC is no longer applicable. The applicable code after the certificate of occupancy is issued is the Property Maintenance Code.

Cost Impact: This code change proposal will not increase the cost of construction.

CE350-13

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

C408-EC-GRACE.doc

CE351 – 13
C408.2, C408.2.1, C408.2.2.1, C408.2.2.2, C408.3.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

SECTION C408
SYSTEM COMMISSIONING

C408.1 General. This section covers the commissioning of the building mechanical systems in Section C403 and electrical power and lighting systems in Section C405.

C408.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* <u>or *approved agency*</u> shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section.

Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units.

C408.2.1 Commissioning plan. A *commissioning plan* shall be developed by a *registered design professiona*l or approved *agency* and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3. Functions to be tested, including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed. ~~At a minimum,~~ Testing shall affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

C408.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include air system and hydronic system balancing.

C408.2.2.1 Air systems balancing. Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (0.74 kW), fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp (0.74 kW) or less <u>are not required to be provided with a means for air balancing</u>.

C408.2.2.2 Hydronic systems balancing. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions: <u>The following equipment are not required to be equipped with means for balancing or measuring flow:</u>

1. Pumps with pump motors of 5 hp (3.7 kW) or less.
2. Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

C408.2.3 Functional performance testing. Functional performance testing specified in Sections C408.2.3.1 through C408.2.3.3 shall be conducted.

C408.2.3.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

1. All modes as described in the *sequence* of *operation*;
2. Redundant or *automatic* back-up mode;
3. Performance of alarms; and
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(3) that do not require supply air economizers.

C408.2.3.2 Controls. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with *approved* plans and specifications.

C408.2.3.3 Economizers. Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

C408.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

C408.2.4.1 Acceptance of report. *Buildings*, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

C408.2.4.2 Copy of report. The *code official* shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the *code official*.

C408.2.5 Documentation requirements. The *construction documents* shall specify that the documents described in this section be provided to the *building* owner within 90 days of the date of receipt of the *certificate of occupancy*.

C408.2.5.1 Drawings. *Construction documents* shall include the location and performance data on each piece of equipment.

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

C408.2.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section C408.2.2.

C408.2.5.4 Final commissioning report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

C408.3 Lighting system functional testing. Controls for automatic lighting systems shall comply with Section C408.3.

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405. Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirm<u>ation</u> that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
2. Confirm<u>ation</u> that the time switches and programmable schedule controls are programmed to turn the lights off.

3. Confirmation that the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

Reason: This proposal was submitted by the ICC Sustainability Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the SEHPCAC has held 3 open meetings and over 30 workgroup calls which included members of the SEHPCAC as well as any interested party to discuss and debate proposed changes and public comments. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx.

The changes proposed are intended to accomplish consistency between IECC and IgCC commissioning provisions; to clarify the application of various exceptions, and consistency of phrasing and terminology. If the changes to the IECC are approved, a companion change will be submitted by the SEHPCAC for 2014.

Specific changes are:

- C408.2.1 – Replaces the 'as a minimum in item 4 with a new item 6 which makes it clear that the registered design professional should include other elements in the commissioning plan beyond the listed 5 where the designer sees such is appropriate.
- C408.2.2.1 – Provides a complete sentence for the exception. As the preceding paragraph has multiple requirements, it is essential that the exception clearly state the provisions which are 'excepted'.
- C408.2.2.2 – Completes the exceptions; clarifies what is being 'excepted'.
- C408.3.1 – A grammatical clean-up. The lead in text states that 'the following procedures shall be performed". The text of the 3 listed items are commands, not procedures.

Cost Impact: The code change proposal will not increase the cost of construction. The proposal is editorial in nature and will not affect the cost of construction.

CE351-13

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

C408.2-EC-THOMPSON-SEHPCAC

CE352 – 13
C408.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2 Mechanical systems commissioning and completion requirements. Prior to ~~passing~~ the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section.

Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

Reason: The current code requires something to be done in advance of a future event. The registered design professional can only provide something either prior to an inspection or after passage of the inspection. This proposal clarifies the order in which commissioning events take place, to clarify the code to foster implementation and compliance verification.

Cost Impact: The code change proposal does not increase the cost of construction.

CE352-13

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

C408.2-#1-EC-WILLIAMS.doc

CE353 – 13
C408.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section.

Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exceptions: The following systems are exempt ~~from the commissioning requirements~~:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve individual dwelling units and sleeping units ~~in hotels, motels, boarding houses or similar units~~

Reason: This proposal simplifies and clarifies the exceptions to required mechanical systems commissioning. The objective of this proposal is to clarify the code to foster implementation and compliance verification. It is also not necessary in an exception to re-state the topic in the parent section to which the exception applies. The term "sleeping unit" is defined in the code so the delineation of where such units may or may not occur is not needed and is confusing. The intent, regardless of the type of building in which they are located, is that the systems serving individual sleeping units need not be commissioned. The word "individual" is added so that complex central systems serving multiple sleeping units would not be exempt from commissioning.

Cost Impact: The code change proposal will not increase the cost of construction.

CE353-13

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

C408.2 #2-EC-WILLIAMS.doc

CE354 – 13
C408.2.2.1

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (Amanda@InterCodeinc.com)

Revise as follows:

C408.2.2.1 Air system balancing. Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers <u>used for air system balancing</u> are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp (0.74 kW), fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp (0.74 kW) or less.

Reason: Discharge dampers are often used to shield a building area from rain and snow when the fan is not operating. In these situations, dampers use no energy when the fan is off and a minuscule amount of energy when the fan is running.

The added language provides clarity to this section and ensures that the restriction on discharge dampers only applies to those used for air balancing purposes. Disallowing discharge dampers altogether would constitute a restriction and energy loss while the fan is running.

Cost Impact: This proposal will not increase the cost of construction.

CE354-13

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

C408.2.2.1-EC-HICKMAN.doc

CE355 – 13
C408.2.4.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2.4.1 Acceptance of report. *Buildings,* or portions thereof, shall not be considered acceptable for a final inspection pursuant to Section C104.3 ~~pass the final mechanical inspection~~ until ~~such time as~~ the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

Reason: This proposal revises the commissioning provision so that buildings cannot be considered for a final inspection (e.g., do not pass the mechanical inspection) until the owner indicates in writing they have the required commissioning report. This clarifies the code through the reference section for final inspections and eliminates unneeded language "such time as".

Cost Impact: The code change proposal will not increase the cost of construction.

CE355-13

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

C408.2.4.1-EC-WILLIAMS.doc

CE356 – 13
C408.2.5.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.
6. Operation and maintenance manuals for each piece of lighting equipment. Required routine maintaince actions, cleaning and recommended relamping shall be clearly identified.
7. A schedule for inspecting and recalibrating all lighting controls.
8. A narrative of how each system is intended to operate, including recommended setpoints.

Reason: The current requirements for manuals seems specific to HVAC documentation. This proposal adds additional language for the documentation, maintenance, and inspection of lighting equipment and controls. These requirements are consistent with ANSI/ASHRAE/IES Standard 90.1

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

CE356-13

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

C408.2.5.2-EC-FERGUSON.doc

CE357– 13
C408.3.1

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. ~~The construction documents shall state the party who will conduct the required functional testing.~~ Where required by the code official, an approved ~~party~~ individual independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
    - 1.1. For projects with up to seven occupancy sensors, all occupancy sensors shall be tested
    - 1.2. For projects with more than seven the following shall be verified:
        - 1.2.1. Status indicator (as applicable) operates correctly
        - 1.2.2. The controlled lights turn off or down to the permitted level within the required time,
        - 1.2.3. For auto-on occupant sensors, the lights do turn on to the permitted level when someone enters the space,
        - 1.2.4. For manual on sensors, the lights turn on only when manually activated
        - 1.2.5. The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that all control devices for daylight controls have been properly located, field-calibrated, and set for design set points and threshold light levels. All daylight control devices shall only be readily accessible to authorized personnel. ~~the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.~~

Reason: For consistency with ASHRAE/IES 90.1. These revisions add more specific requirements to the functional testing of lighting controls for the common controls required by the standard and adds some clarification to the description of entities allowed to perform the testing and verification.

Cost Impact: The code change proposal will increase the cost of construction when lighting controls are required in parking garages.

CE357-13

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

C408.3.1-EC-FERGUSON.doc

CE358 – 13

C408.4 (NEW), C408.4.1 (NEW), C408.4.1.1 (NEW), C408.4.1.2 (NEW), C4038.4.1.3 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C408.4 Service water heating systems commissioning and completion requirements. Service water heating equipment and controls shall comply with Section 408.4. Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements.

Exception: The following systems are exempt from the commissioning requirements:

1. Service water heating systems in buildings where the largest service water heating system capacity is less than 200,000 Btu/h (58 562 W) and where there are no pools or inground permanently installed spas.

C408.4.1 Functional performance testing. Functional performance testing specified in Sections C408.4.1.1 through C408.4.1.3 shall be conducted. Written procedures which clearly describe the individual systematic test procedures, the expected systems' response or acceptance criteria for each procedure, the actual response or findings, and any pertinent discussion shall be followed. Testing shall affirm operation with the system under 50 percent water heating load.

C408.4.1.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

1. Redundant or *automatic* back-up mode;
2. Performance of alarms; and
3. Mode of operation upon a loss of power and restoration of power.

C408.4.1.2 Controls. Service water heating controls shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with *approved* plans and specifications.

C408.4.1.3 Pools and spas. Service water heating equipment, time switches, and heat recovery equipment which serve pools and inground permanently installed spas shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

Reason: Large water heating systems (over 200,000 Btu/h) require some fundamental testing of their full sequence of operation and their recovery to normal operations after various emergency conditions. This additional commissioning is inexpensive and provides potential for significant long-term energy savings. Pools and in-ground spas are included, to ensure that their heaters, time switches and heat recovery systems are functioning properly.

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

CE358-13

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

C408.4 (NEW) #2-EC-NOGLER.doc

CE359 – 13
C408.4 (NEW), C408.4.1 (NEW), C409 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C408.4 Metering system commissioning. Energy metering systems required by Section 409 shall comply with Section 408.5 and be included in the commissioning process required by Section 408.1. Construction documents shall clearly indicate provisions for *commissioning* in accordance with section 408 and are permitted to refer to specifications for further requirements.

C408.4.1 Functional testing. Functional testing shall be conducted by following written procedures which clearly describe the individual systematic test procedures, the expected systems' response or acceptance criteria for each procedure, the actual response or findings, and any pertinent discussion. Functional testing shall document that energy source meters, energy end-use meters, the energy metering data acquisition system, and required energy consumption display are calibrated, adjusted and operate in accordance with approved plans and specifications. Testing shall confirm that:

1. The metering system devices and components work properly under low and high load conditions
2. The metered data is delivered in a format that is compatible with the data collection system
3. The energy display is accessible to building operation and management personnel
4. The energy display meets code requirements regarding views required in Section 409.4.3. The display shows energy data in identical units (e.g. kWh).

SECTION C409
ENERGY METERING AND ENERGY CONSUMPTION MANAGEMENT

C409.1 General. Buildings with a gross conditioned floor area greater than 50,000 square feet shall comply with Section C409. Buildings shall be equipped to measure, monitor, record and display energy consumption data for each energy source and end use category per the provisions of this section, to enable effective energy management.

Exceptions:

1. Tenant spaces within buildings where the tenant space has its own utility services and utility meters and the space is less than 25,000 square feet gross conditioned floor area.
2. Buildings in which there is no gross conditioned floor area greater than 25,000 square feet, including building common area, that is served by its own utility services and utility meters.

C409.1.2 Alternate metering methods. Where approved by the code official, energy use metering systems are permitted to differ from those required by this section, provided that they are permanently installed and that the source energy measurement, end use category energy measurement, data storage and data display have similar accuracy to and are at least as effective in communicating actionable energy use information to the building management and users, as those required by this section.

C409.1.2 Conversion factor. Any threshold stated in kW shall include the equivalent BTU/heating and cooling capacity of installed equipment at a conversion factor of 3,412 BTU per kW at 50 percent demand.

C409.2 Energy source metering. Buildings shall have a meter at each energy source. For each energy supply source listed in Sections C409.2.1 through C409.2.4, meters shall be capable of collecting data for the whole building, or for each separately metered portion of the building where permitted by the Exceptions to Section C409.1.

Exceptions:

1. Energy source metering is not required where end use metering for an energy source accounts for all usage of that energy type within a building, and the data acquisition system accurately totals the energy delivered to the building or separately-metered portion of the building.
2. Solid fuels such as coal, firewood or wood pellets that are delivered via mobile transportation do not require metering.

C409.2.1 Electrical energy. Metering shall be provided for electrical energy supplied to the building and its associated site, including site lighting, parking, recreational facilities, and other areas that serve the building and its occupants.

C409.2.2 Gas and liquid fuel supply energy. Metering shall be provided for natural gas, fuel oil, propane and other gas or liquid fuel energy supplied to the building and site.

C409.2.3 District energy. Metering shall be provided for net energy extracted from district steam systems, district chilled water loops, district hot water systems, or other energy sources serving multiple buildings.

C409.2.4 Site-generated renewable energy. Metering shall be provided for net energy generated from on-site solar, wind, geothermal, tidal or other natural sources.

C409.3 End-use metering. Meters shall be provided to collect energy use data for each end-use category listed in Sections C409.3.1 and C409.3.2. Meters shall be capable of collecting data for the whole building or for each separately metered portion of the building where permitted by the Exceptions to Section C409.1. Multiple meters are permitted to be used for any end-use category, provided that the data acquisition system totals all of the energy used by that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2. Separate metering is not required for fire pumps, stairwell pressurization fans or other life safety systems that operate only during testing or emergency.
3. End use metering is not required for individual tenant spaces not greater than 2,500 square feet in floor area where a dedicated source meter meeting the requirements of Section C409.4.1 is provided for the tenant space.

C409.3.1 HVAC system energy use. Submetering shall be provided for energy including electrical, gas, liquid fuel, district steam and district chilled water that is used by boilers, chillers, pumps, fans and other equipment used to provide space heating, space cooling, dehumidification and ventilation to the building, but not including energy that serves process loads, water heating or miscellaneous loads as defined in Section C409.3. Multiple HVAC energy sources, such as gas, electric and steam, are not required to be summed together.

Exceptions:

1. 120 volt equipment.
2. 208/120 volt equipment in a building where the main service is 480/277 volt power.

C409.3.2 Water heating energy use. Submetering shall be provided for energy used for heating of domestic and service hot water, but not energy used for space heating.

Exception: Water heating energy use less than 50 kW does not require end-use metering.

C409.4 Meters. Meters and other measurement devices required by Section C409 shall be configured to automatically communicate energy data to a data acquisition system. Source meters are permitted to be any digital-type meters. Current sensors or flow meters are allowed for end use metering, provided that they have a tested accuracy of plus or minus 2 percent. Required metering systems and equipment shall provide at least hourly data that is fully integrated into the data acquisition and display system per the requirements of Section C409.

C409.5 Data acquisition system. The data acquisition system shall be capable of storing the data from meters and other sensing devices for a minimum of 36 months. For each energy supply and end use category required by Sections C409.2 and C409.3, it shall provide real-time energy consumption data and logged data for any hour, day, month or year.

C409.6 Energy display. For each building subject to Section C409, either a permanent, readily accessible and visible display, or a web page or other electronic document accessible to building management or to a third-party energy data analysis service shall be provided in the building accessible by building operation and management personnel. The display shall be capable of graphically displaying the current energy consumption rate for each whole building energy source, plus each end use category, as well as the average and peak values for any day, week or year.

C409.7 Commissioning. The entire system shall be commissioned in accordance with Section C408.5. Deficiencies found during testing shall be corrected and re-tested and the commissioning report shall be updated to confirm that the entire metering and data acquisition and display system is fully functional.

C409.8 Existing buildings that were constructed subject to the requirements of this Section. Where new or replacement systems or equipment are installed in an existing building that was constructed subject to the requirements of this Section, metering shall be provided for such new or replacement systems or equipment so that their energy use is included in the corresponding end-use category defined in Section C409.2. This includes systems or equipment added in conjunction with additions or alterations to existing buildings.

C409.8.1 Additions. For existing buildings smaller than 50,000 square feet that were subject to the requirements of this section, where an addition increases the total conditioned floor area by more than 50 percent of the existing building area and causes the total building conditioned floor area to exceed 50,000 square feet, metering and data acquisition systems shall be provided for the new additions over 25,000 square feet in accordance with the requirements of Sections C409.2 and C409.3.

Reason: Energy metering is a critical tool to achieve actual energy savings in buildings. This proposal comes from the State of Washington amendments to the 2012 IECC. Washington state adopted section 409 energy metering based on based on input from energy conservation experts, and experience implementing the metering systems in high performance buildings.

Use of “advanced meters” with a data acquisition and display system, rather than standard utility meters, provides several opportunities for energy savings. This is why the 2013 Edition of ASHRAE 90.1 will have metering requirements, the EPAct 2005 requires extensive metering retrofits for existing federal buildings, the Department of Defense requires metering for almost all new construction and alteration projects, LEED provides credits for continuous metering, and ASHRAE Standard 189.1 mandates extensive metering and sub-metering. The DOE Metering Best Practices Guide, Table 8.1, estimates typical savings from metering to be 5% - 15% with more extensive savings sometimes realized. (Elsewhere in the Guide a more conservative estimate of 2% - 10% is cited.) Specific benefits include

- Advanced metering & sub-metering provides automatic benchmarking of building energy use patterns
- Allows comparison of actual energy use for new buildings to modeled energy use
- Advanced metering and Sub-metering will decrease building energy use
    - A recent study in the Puget Sound area showed that more than half of all economizers are not functioning correctly. In most cases, the building owners are not aware of this condition.
- Advanced metering allows building managers to track energy use over time.
    - Data trending provided in the dashboard shows how the building is doing compared to other time periods.
    - Allows building managers to detect system malfunctions and incorrect control settings

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

CE359-13

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

C408.4 (NEW)- #1-EC-NOGLER.doc

CE360 – 13
C409 (NEW)

Proponent: Duane Jonlin, City of Seattle, representing City of Seattle Department of Planning and Development (duane.jonlin@seattle.gov)

Add new text as follows:

SECTION C409
ENERGY CONSUMPTION MANAGEMENT

C409.1 General. Buildings with a gross conditioned floor area larger than 20,000 square feet shall comply with Section C409. Buildings shall be equipped to measure, monitor, record and display energy consumption data for each energy supply and end use category in accordance with this section.

Exceptions:

1. Spaces of less than 10,000 square feet gross conditioned floor area, occupied by one tenant and served by independent utility services and utility meters .
2. Building common areas totaling less than 10,000 square feet gross conditioned floor area and served by independent utility services and utility meters.

C409.2 Energy supply metering. Buildings shall have a meter at each energy supply source. For each energy supply source listed in Sections C409.2.1 through C409.2.4, meters shall be capable of collecting data for the whole building or for each separately metered portion of the building.

Exceptions:

1. Energy supply source metering is not required where end use metering for an energy source accounts for all usage of that energy type within a building, and the data acquisition system accurately totals the energy delivered to the building or separately-metered portion of the building.
2. Solid fuels, including, but not limited to, coal, firewood or wood pellets that are delivered via mobile transportation do not require metering.

C409.2.1 Electrical energy. Meters shall collect data for electrical energy supplied to the building and its associated site, including site lighting, parking, recreational facilities, and other areas that serve the building and its occupants.

C409.2.2 Gas and liquid fuel supply energy. Meters shall collect data for natural gas, fuel oil, propane and other gas or liquid fuel energy supplied to the building and site.

C409.2.3 District energy. Meters shall collect data for net energy extracted from district steam systems, district chilled water loops, district hot water systems, or other energy sources serving multiple buildings.

C409.2.4 Site-generated renewable energy. Meters shall collect data for net energy generated from on-site solar, wind, geothermal, tidal or other natural sources.

C409.3 End-use metering. Meters shall be provided to collect energy use data for each end-use category listed in Sections C409.3.1 through C409.3.5. These meters shall be capable of collecting data for the whole building or for each separately metered portion of the building other than those subject to the exceptions to Section C409.1. Multiple meters are permitted to be used for any end-use category, provided that the data acquisition system totals all of the energy used by that category. Thresholds stated in kW shall include the equivalent BTU/h heating and cooling capacity of installed equipment at a conversion factor of 3,412 BTU per kW at 50 percent demand.

Exceptions:

1. End-use metering is not required for HVAC and water heating equipment serving only an individual dwelling unit.
2. Separate metering is not required for fire pumps, stairway pressurization fans or other life safety systems that operate only during testing or emergency.
3. End use metering is not required for individual tenant spaces not exceeding 2,500 square feet in floor area when a dedicated supply meter meeting the requirements of Section C409.4.1 is provided for the tenant space.
4. Not more than 5 percent of the total connected load of any of the end-use metering categories in Sections C409.3.1 through C409.3.7 is permitted to be excluded from that end-use data collection.
5. Not more than 5 percent of the total connected load of any of the end-use metering categories in Sections C409.3.1 through C409.3.7 is permitted to consist of loads not part of that category.

C409.3.1 HVAC system energy use. Meters shall collect energy use data for electrical, gas, liquid fuel, district steam and district chilled water that is used by equipment used to provide space heating, space cooling, dehumidification and ventilation to the building, but not including energy that serves process loads or water heating. Multiple HVAC energy sources, such as gas, electric and steam, are not required to be summed together.

Exceptions:

1. 120 volt equipment is not required to be included in the HVAC system metering.
2. 208/120 volt equipment in a building where the main service is 480/277 volt power is not required to be included in the HVAC system metering.

C409.3.2 Water heating energy use. Meters shall collect energy use data for heating of domestic and service hot water, but not energy used for space heating.

Exception: Water heating energy loads less than 50 kVA do not require end-use metering.

C409.3.3 Lighting system energy use. Meters shall collect data for energy used by interior and exterior lighting, but not including plug-in task lighting.

C409.3.4 Plug load system energy use. Meters shall collect data for energy used by appliances, computers, plugged-in task lighting, and other equipment and devices, but not including vertical transportation equipment or equipment covered by other end-use metering categories listed in C409.3.

Exception: Where the total capacity of plug load circuits is less than 50 kVA, end-use metering is not required.

C409.3.5 Process load system energy use. Meters shall collect data for energy used by any non-building process load (e.g. nonresidential refrigeration and cooking, industrial equipment).

Exception: Process load energy use less than 50 kVA does not require end-use metering.

C409.4 Measurement devices, data acquisition system and energy display. Each building or separately metered portion of a building shall provide measurement devices, a data acquisition system and an energy display in accordance with this section.

C409.4.1 Measurement devices. Meters and other measurement devices shall be configured to automatically communicate energy data to a data acquisition system. Digital-type meters are permitted to be used as supply source meters. Current sensors or flow meters are allowed for end use metering, provided that they have a tested accuracy of plus or minus 2 percent. Required metering systems and equipment shall provide at least hourly data that is fully integrated into the data acquisition and display systems required by Section C409.4.

C409.4.2 Data acquisition system. The data acquisition system shall be capable of storing the data from the required meters and other sensing devices for a minimum of 36 months. For each energy supply and end use category required by Sections C409.2 and C409.3, the data acquisition system shall provide real-time energy consumption data and logged data for every hour, day, month or year.

C409.4.3 Energy display. For each building subject to Section C409, either a permanent, readily accessible and visible display, or a web page or other electronic document accessible to building management or to a third-party energy data analysis service shall be provided for the building and shall be accessible to building operation and management personnel. The display shall be capable of graphically displaying the current energy consumption rate for each whole building energy supply, plus each end use category, as well as the average and peak values for every day, week and year.

C409.5 Metering for existing buildings. Where new or replacement systems or equipment are installed in an existing building that was constructed subject to the requirements of Section C409, metering shall be provided for such new or replacement systems or equipment so that their energy use is included in the corresponding end-use category defined in Section C409.3.

Reason: The energy code is approaching a limit to the ability to control energy use solely through design and construction. Increasingly, savings will need to come from the informed use and operation of our buildings, for which end-use metering is a fundamental building block. This proposal is developed based on Seattle's experience implementing a metering code during the 2009 code cycle. It segregates out basic energy use categories to facilitate visualization of patterns and evaluate the impact of changes.

Advanced metering displays save significant energy by providing building owners and managers the tools to monitor and manage energy usage. Use of "advanced meters" rather than standard utility meters provides multiple opportunities for energy savings:

- Benchmarking and data trending of building energy use patterns, so that anomalies are easily detectable
- Comparison of actual energy use of new building systems to modeled energy use
- Evaluating the impact of changes and interventions
- Identifying and correcting system malfunctions

The DOE Metering Best Practices Guide, Table 8.1, estimates typical savings from metering to be 5% - 15% with more extensive savings sometimes realized. EPAct 2005 requires extensive metering retrofits for existing federal buildings, the Department of Defense requires metering for almost all new construction and alteration projects, LEED provides credits for continuous metering, and ASHRAE Standard 189.1 mandates extensive metering and sub-metering.

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

CE360-13

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

C409 (NEW)-EC-JONLIN.doc

CE361 – 13
C202 (NEW), C410 (NEW)

Proponent: Duane Jonlin, City of Seattle, representing City of Seattle Department of Planning and Development (duane.jonlin@seattle.gov)

Add new text as follows:

C410.1 General. A *solar zone* shall be provided for buildings which are five stories or less in height above grade plane, and shall be located on the roof of the building or elsewhere on the site. The *solar zone* shall comply with Sections C410.2 through C410.8 and *the International Fire Code*.

Exceptions:

1. A solar zone is not required where the solar exposure of the building's roof area is less than 75 percent of that of an unobstructed area in the same location, as measured by one of the following:
    - 1.1. Incident solar radiation expressed in kWh/ft^2-yr using typical meteorological year (TMY) data
    - 1.2. Annual sunlight exposure expressed in cumulative hours per year using TMY data
    - 1.3. Shadow studies indicating that the area is more than 25 percent in shadow, on September 21 at 10am, 11am, 12pm, 1pm, and 2pm solar

2. Subject to the approval of the code official, buildings with extensive rooftop equipment that would make full compliance with this section impractical shall be permitted to provide a smaller *solar zone* than that required by Section C410.3.

C410.2 Minimum area. The minimum area of the *solar zone* shall be determined in accordance with Section C410.2.1 or C410.2.2, whichever results in the smaller area.

C410.2.1 Percentage of roof area. An area equal to 40 percent of the roof area calculated as the horizontally-projected gross roof area less the area covered by skylights, occupied roof decks and planted areas.

C410.2.2 Percentage of electrical service size. The electrical service size shall be the rated capacity of the total of all electrical services to the building, and the required *solar zone* size shall be based upon 10 peak watts of PV per square foot for 20 percent of the size of the electrical service.

C410.3 Obstructions. The *solar zone* shall be free of pipes, vents, ducts, HVAC equipment, skylights and other obstructions, except those serving PV or SWH systems within the solar zone. PV and SHW systems are permitted to be installed within the solar zone.

C410.4 Shading. Any existing or new object on the building or site that is located south, east, or west of the *solar zone* shall be set back from the *solar zone* a distance at least two times its height above the roof surface. Such objects include but are not limited to taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings. The *solar zone* shall not be located on a roof slope greater than 2:12 that faces within 45° of true north.

C410.5 Non-contiguous area. The *solar zone* is permitted to be comprised of smaller separated sub-zones. Each subzone shall be at least 5 feet wide in the narrowest dimension.

C410.6 Access. Areas contiguous to the *solar zone* shall provide access pathways and provisions for emergency smoke ventilation as required by the *International Fire Code.*

C410.7 Structural integrity. Where the *solar zone* is on the roof of the building or another structure on the site, the as-designed dead load and live load for the *solar zone* shall be clearly marked on the construction documents, and shall accommodate future PV or SHW arrays at an assumed dead load of 5 pounds per square foot in addition to other required live and dead loads. For PV systems, a location for inverters shall be designated either within or adjacent to the solar zone, with a minimum area of 2 square feet for each 1000 square feet of solar zone area, and shall accommodate an assumed dead load of 175 pounds per square foot.

C410.8 PV or SWH interconnection provisions. Buildings shall provide for the future interconnection of either a PV system in accordance with Section C410.2.8.1 or an SWH system in accordance with Section C410.2.8.2.

C410.2.8.1 PV interconnection. A capped roof penetration sleeve shall be provided in the vicinity of the future inverter, sized to accommodate the future PV system conduit. Interconnection of the future PV system shall be provided for at the main service panel, either ahead of the service disconnecting means or at the end of the bus opposite the service disconnecting means, in one of the following forms:

1. A space for the mounting of a future overcurrent device, sized to accommodate the largest standard rated overcurrent device that is less than 20 percent of the bus rating; or
2. Lugs sized to accommodate conductors with an ampacity of at least 20 percent of the bus rating, to enable the mounting of an external overcurrent device for interconnection.

The electrical construction documents shall indicate the following:

1. Solar zone boundaries and access pathways;
2. Location for future inverters and metering equipment; and
3. Route for future wiring between the PV panels and the inverter, and between the inverter and the main service panel.

C410.2.8.2 SWH interconnection. Two capped pipe tees shall be provided upstream of the domestic water heating equipment to provide plumbing interconnections between a future SWH system and the domestic water heating system. Two roof penetration sleeves shall be provided in the vicinity of the solar zone, capable of accommodating supply and return piping for a future SWH system.

The plumbing construction documents shall indicate the following:

1. Solar zone boundaries and access pathways;
2. Location for future hot water storage tanks; and
3. Route for future piping between the solar zone and the plumbing interconnection point, following the shortest feasible pathway.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

SOLAR ZONE. A clear area or areas reserved solely for current and future installation of photovoltaic or solar hot water systems.

Reason: The cost of photovoltaic and solar water heating systems has declined markedly in recent years, but at this point they are still only marginally cost-effective. However, their cost continues to decline, and this rule will prepare our new building stock to easily install such systems at an appropriate time. As energy costs rise and solar generation costs decline, a point will be reached where large solar energy systems are a viable investment. This rule brings that date closer in time by clearing away any physical impediments to future installation.

The rule requires an unobstructed "solar zone" for most non-residential buildings of five stories or less, either 40 percent of the building's roof area, or an area large enough to generate 20% of the building's electricity.

Example: A building with a 10,000 SF total roof area, 1,000 SF skylight area, and a 400 Amp, 240 volt single phase electrical service is required to provide a solar zone area of the smaller of the following:

1. [40% x (10,000 SF roof area – 1,000 SF skylights)] = 3,600 SF, or
2. [400 Amp x 240 Volts x 20% / 10 watts per SF] = 1,920 SF
   Therefore, a solar zone of 1,920 square feet is required

The solar zone requires a dedicated pathway for future connection to the electrical or water heating system, and may also be located above carports, canopies, or elsewhere on the building or site. Exemptions are provided for roofs that are extensively shaded or congested with equipment.

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

CE361-13

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

C410 (NEW)-EC-JONLIN.doc