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Differences Between the 1995 CABO Model Energy Code and the 1998 ICC International Energy Conservation Code

R. G. Lucas
D. B. Meyers[a]
April 2000

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

(a) Building Officials and Code Administrators International, Inc.

OFFICE OF
BUILDING TECHNOLOGY,
STATE AND COMMUNITY PROGRAMS

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EXECUTIVE SUMMARY

The Energy Policy Act of 1992 (EPACT, P.L. 102-486, 16 USC 1531 et seq., as amended) requires that the U.S. Department of Energy (DOE) determine whether revisions to the Council of American Building Officials' (CABO) *1995 Model Energy Code* (MEC) will improve energy efficiency in residential buildings (CABO 1995).[(a)] The 1998 edition of the International Code Council's (ICC) *International Energy Conservation Code* (IECC) is the successor to 1995 MEC under EPACT (ICC 1998). The IECC includes the technical content of the MEC as modified by code changes approved during the 1995, 1996, and 1997 code development cycles. This report describes all revisions to the 1995 MEC published in the 1998 IECC.

To help the states and others identify and understand the impacts of these code changes, Pacific Northwest National Laboratory (PNNL) (under DOE's direction) and Building Officials and Code Administrators International, Inc. (BOCA), identified the changes and their impacts. A summary of the significant changes to the MEC that were considered and approved during the 1995, 1996, and 1997 code development cycles and incorporated in the 1998 IECC are as follows:

- The IECC's chapters were reorganized to improve utility. Chapter 6 in the MEC, "Residential Building Design by Acceptable Practice," was integrated into Section 502.2 of the IECC. The commercial building provisions that reference the *Energy Code for Commercial and High-Rise Residential Buildings* (ASHRAE 1993b) (90.1 Code; a.k.a., the codification of *ASHRAE/IES Standard 90.1-1989*, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" [90.1 Standard, ASHRAE 1989a]) were moved from Chapter 7 to Chapter 6. A new Chapter 7, "Design by Acceptable Practice for Commercial Buildings," was added. The length of Chapter 3 greatly increased because state maps and climate zones were added as required by the new Chapter 7.

- Provisions were added establishing a maximum solar heat gain coefficient (SHGC) requirement of 0.4 for fenestration in traditionally cooling dominated climates (locations with heating degree-days [HDD] <3,500). The IECC adds a reference to the National Fenestration Rating Council (NFRC) Standard 200-95 for determining fenestration product SHGC and provides default values for products not rated by this NFRC standard (NFRC 1995).

- A new thermal envelope compliance method using prescriptive, specification-oriented tables was added (Section 502.2.4, "Compliance by prescriptive specification on an individual component basis").

- A new Section 107, "Referenced Standards," was added to Chapter 1, establishing that the IECC's requirements take precedence when they conflict with requirements of standards referenced by the IECC. For example, the IECC's Administration and Enforcement criteria supercede the administrative criteria of the 90.1 Code as referenced in Chapter 6.

- The IECC now explicitly gives building officials the authority to approve the use of alternative compliance tools that facilitate the implementation of the IECC, such as work sheets and software products.

- By incorporating a new, prescriptive, specification-oriented table, the IECC now has provisions for prescriptive thermal envelope compliance for additions less than 500 ft^2 with a total glazing area no greater

(a) Residential buildings are considered to be one- and two-family dwellings, townhouses, row houses, apartment houses, convents, monasteries, rectories, fraternities and sororities, dormitories, and rooming houses, all of which are three stories or less in height above grade. All other buildings are considered commercial buildings (including hotels, motels, and high-rise multifamily buildings) for the purpose of this report.

than 40% of the addition's gross wall and roof area.

- Default *U*-factor tables for glazed fenestration products were revised consistent with the *1997 ASHRAE Handbook - Fundamentals* (ASHRAE 1997).

- New provisions defining the input variables used as the basis for the systems analysis comparison in Chapter 4 were added in areas such as shading coefficients, control system parameters, internal heat gains, air distribution system loss factors, and air infiltration.

- Prescriptive requirements for the insulation of skylight shaft walls based on HDD were added.

- The reference to several window manufacturing standards was replaced with a reference to a single, unified window standard, *AAMA/NWWDA 101-97*, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," that places more restrictive air infiltration limitations on manufactured window and door products (AAMA/NWWDA 1997).

- Section 503, "Building Mechanical Systems and Equipment," was revised to reflect only those requirements specific to residential buildings. Provisions and referenced standards specific to mechanical systems and equipment found in commercial buildings were removed, placing emphasis for this information on the 90.1 code requirements as adopted by reference in Chapter 6.

- Storage hot water tanks with vertical risers in noncirculating systems are now required to have either integral heat traps or external heat traps on both the inlet and outlet piping to the water heater.

- Chapter 7, "Design by Acceptable Practice for Commercial Buildings," was added to introduce a simplified compliance approach to the IECC for implementing commercial building energy code requirements. Chapter 7 includes provisions consistent with the 90.1 Code, specific to commercial buildings not over three stories in height with "reasonable" glass areas and "simple" mechanical systems.

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1.0 INTRODUCTION

The Energy Policy Act of 1992 (EPACT, P.L. 102-486, 16 USC 1531 et seq., as amended) requires that the U.S. Department of Energy (DOE) determine whether changes to the Council of American Building Officials' (CABO) *1995 Model Energy Code* (MEC) will improve energy efficiency in residential buildings (CABO 1995). The 1998 edition of the International Code Council's (ICC) *International Energy Conservation Code* (IECC) is the successor to 1995 MEC under EPACT (ICC 1998). The IECC includes the technical content of the MEC as modified by code changes approved during the 1995, 1996, and 1997 code development cycles.

EPACT also requires all states to adopt a commercial building energy code equivalent to *ASHRAE/IES Standard 90.1-1989*, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" (90.1 Standard) (ASHRAE 1989a). The MEC and IECC reference the *Energy Code for Commercial and High-Rise Residential Buildings* (90.1 Code; a.k.a., the codified counterpart of the 90.1 Standard) (ASHRAE 1993b). The IECC now contains a new Chapter 7, "Design by Acceptable Practice for Commercial Buildings," as an alternative to the 90.1 Code.

To help the states and others identify and understand the impact of the changes to the MEC published in the IECC, Pacific Northwest National Laboratory (PNNL)[(a)] (under DOE's direction) and Building Officials and Code Administrators International, Inc. (BOCA), identified these changes and their potential impacts.

Section 2.0 of this report describes each change to the MEC, and how these changes affect residential and commercial buildings. Referenced publications are listed in Section 3.0, and an Errata to the IECC is provided in the Appendix.

(a) PNNL is operated by Battelle for the U.S. Department of Energy.

2.0 CHANGES TO THE 1995 MEC PUBLISHED IN THE 1998 IECC

Effective December 4, 1995, CABO assigned all rights and responsibilities for the MEC to the ICC. The first edition of the IECC issued in 1998 therefore replaced the 1995 CABO MEC. To facilitate the transfer of responsibility, the Secretariat, committee members, by laws, procedures, standards criteria, public hearings, code change procedures, appeals procedures, and guidelines were simply redesignated as ICC activities without change.

In its first edition, the IECC incorporates the provisions of the 1995 edition of the MEC promulgated by CABO and includes the technical content of the MEC as modified by the approved changes from the 1995, 1996, and 1997 CABO code development cycles carried out under the CABO code change process. The MEC, first published in 1983, was developed jointly by BOCA, the International Conference of Building Officials (ICBO), the National Conference of States on Building Codes and Standards (NCSBCS), and the Southern Building Code Congress International, Inc. (SBCCI), under a contract funded by DOE. The IECC is published triennially but is revised annually through the ICC's code development process, a democratic public hearing and revision procedure for the continued development and maintenance of the ICC International Codes. Following each annual revision, an Accumulative Supplement is issued containing changes approved by the memberships of BOCA, ICBO and SBCCI at their annual meeting(s). The supplement is prepared in a format that permits ready adoption by reference so jurisdictions will have the benefit of the latest developments in building regulations.

All approved changes to the 1995 MEC, which are contained in the 1998 IECC, significantly affect the code's appearance and content. Perhaps the most noticeable change is a new Chapter 7 that includes comprehensive requirements for "simple," low-rise commercial buildings as alternatives to those found in the 90.1 Code. Chapter 7 is supported by state maps that define climate zones, which were added to Chapter 3. Chapter 6 of the MEC, "Residential Building Design by Acceptable Practice," was consolidated into Chapter 5 of the IECC in a rewritten form. Additionally, several changes to the code's format were made to match the conventions used in all of the ICC International Codes. These changes include adding more section references and headings, adding an index, and restructuring the referenced standards.

Only a few approved changes add or revise specific construction requirements in the code. These changes include requirements for low solar heat gain coefficient (SHGC) fenestration (windows) in the southern United States, heat traps for water heaters, skylight shaft insulation, lower air leakage rates for prefabricated windows and doors, and heat conduction limits for replacement windows and certain additions of less than 500 ft^2.

A summary of the significant changes to the MEC that were considered and approved during the 1995, 1996, and 1997 CABO code development cycles and incorporated in the 1998 IECC are as follows:

- The IECC's chapters were reorganized to improve utility. Chapter 6 in the MEC, "Residential Building Design by Acceptable Practice," was integrated into Section 502.2 of the IECC. The commercial building provisions that reference the *Energy Code for Commercial and High-Rise Residential Buildings* (90.1 Code; a.k.a., the codification of *ASHRAE/IES Standard 90.1-1989*, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" [90.1 Standard]) were moved from Chapter 7 to Chapter 6 (ASHRAE 1993b). A new Chapter 7, "Design by Acceptable Practice for Commercial Buildings," was added. The length of Chapter 3 greatly increased because state maps and climate zones were added as required by the new Chapter 7.

- Provisions were added establishing a maximum SHGC requirement of 0.4 for fenestration in traditionally cooling dominated climates (locations with heating degree-days [HDD] <3,500). The IECC adds a reference to the National Fenestration Rating Council (NFRC) Standard 200-95 for determining fenestration product SHGC and provides default values for products not rated by this NFRC standard (NFRC 1995).

- A new thermal envelope compliance method using prescriptive, specification-oriented tables was added (Section 502.2.4, “Compliance by prescriptive specification on an individual component basis”).

- A new Section 107, “Referenced Standards,” was added to Chapter 1, establishing that the IECC’s requirements take precedence when they conflict with requirements of standards referenced by the IECC. For example, the IECC’s Administration and Enforcement criteria supercede the administrative criteria of the 90.1 Code as referenced in Chapter 6.

- The IECC now explicitly gives building officials the authority to approve the use of alternative compliance tools that facilitate the implementation of the IECC, such as work sheets and software products.

- By incorporating a new, prescriptive, specification-oriented table, the IECC now has provisions for prescriptive thermal envelope compliance for additions less than 500 ft^2 with a total glazing area no greater than 40% of the addition’s gross wall and roof area.

- Default *U*-factor tables for glazed fenestration products were revised consistent with the *1997 ASHRAE Handbook - Fundamentals* (ASHRAE 1997).

- New provisions defining the input variables used as the basis for the systems analysis comparison in Chapter 4 were added in areas such as shading coefficients, control system parameters, internal heat gains, air distribution system loss factors, and air infiltration.

- Prescriptive requirements for the insulation of skylight shaft walls based on HDD were added.

- The reference to several window manufacturing standards was replaced with a reference to a single, unified window standard, *AAMA/NWWDA 101-97*, “Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors,” that places more restrictive air infiltration limitations on manufactured window and door products (AAMA/NWWDA 1997).

- Section 503, “Building Mechanical Systems and Equipment,” was revised to reflect only those requirements specific to residential buildings. Provisions and referenced standards specific to mechanical systems and equipment found in commercial buildings were removed, placing emphasis for this information on the 90.1 code requirements as adopted by reference in Chapter 6.

- Storage hot water tanks with vertical risers in noncirculating systems are now required to have either integral heat traps or external heat traps on both the inlet and outlet piping to the water heater.

- Chapter 7, “Design by Acceptable Practice for Commercial Buildings,” was added to introduce a simplified compliance approach to the IECC for implementing commercial building energy code requirements. Chapter 7 includes provisions consistent with the 90.1 Code, specific to commercial buildings not over three stories in height with "reasonable" glass areas and "simple" mechanical systems.

Changes to the 1995 MEC that were published in the 1998 IECC are identified in Table 1 by section number and the corresponding code change number. The code change numbering system indicates the applicable code to which the change was proposed, and the sequence and year of the code change cycle. For example, E24-97 identifies the 24^{th} code change considered to the energy code (E) reviewed during the 1997 code development cycle.

Table 1. Changes to the 1995 MEC Published in the 1998 IECC

1995 MEC Section	1998 IECC Section	Description of Change	Comments
101.2 101.3 (E1-96)	101.2	Statements regarding abridgement of life safety concerns of other codes were deleted from Section 101.3 and relocated to Section 101.2.	No impact.
101.4.2.1 (E5-97)	101.4.1.1	This section clarifies that portions of buildings with low energy usage, as well as whole buildings with low energy usage, are exempt from the IECC.	No impact, assuming the language "...or portions thereof" in Section 101.4.2.1 was interpreted consistently with the intent of the 90.1 Code. Notwithstanding the change, a discrepancy remains between the threshold peak design rate of energy usage referenced by the IECC (3.4 Btu/h·ft^2) and that of the 90.1 Code (3.5 Btu/h·ft^2).
NEW (E9-97)	101.4.2.4 T101.4.2.4	This section and the accompanying table add new alternative provisions for prescriptive thermal envelope compliance for additions and for any window replacements for Type A-1 Residential Buildings (single-family). These new prescriptive requirements can be used only for additions less than 500 ft^2 having a fenestration area not exceeding 40% of the gross wall and roof area of the addition.	Replacement windows previously had no definitive *U*-factor requirements. The newly required *U*-factors for replacement windows will improve energy efficiency. However, with regard to the prescriptive envelope criteria for certain additions, the change may not improve energy efficiency in residential construction.
102.1.1 (E5-96)	102.1.1	Language was added to help identify materials, equipment, and systems to facilitate a compliance determination.	Provides sufficient information to determine code compliance.
NEW 102.1.3 (E13-97)	102.4 102.4.1	New provisions were added specifying that manufacturer's instructions be followed for all materials, systems, and equipment covered by the IECC.	Clarifies applicability of manufacturer's instructions; may promote "field approval" of certain items.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
102.3 (E6-96) (E7-96) (E38-96) (E10-97)	102.3	New provisions were added to require that fenestration product SHGCs be determined in accordance with *NFRC 200-95* (NFRC 1995), or through a default table of SHGC values based on visually verifiable characteristics.	Facilitates compliance determination and assists with field verification during inspection. Should assure more accurate and realistic thermal properties where SHGC provisions apply.
Table 102.3a (E11-97)	Table 102.3(1)	This change revises the default *U*-factor table for glazed products consistent with the 1997 ASHRAE Handbook of Fundamentals (ASHRAE 1997). Default entries for garden window, curtain wall, and site-assembled glazed products were added.	For certain window types, the default *U*-factors may not lead to improvements in energy efficiency for residential and commercial construction.
103 (E14-97)	103	This section was revised to allow building officials to approve compliance tools that facilitate the implementation of the IECC.	Clarifies that the code official has the authority to approve software or paper-based procedures for demonstrating code compliance.
NEW (E11-96)	107.2	This section adds new provisions to establish that the IECC takes precedence over reference standards when there are conflicting requirements.	If the IECC has different requirements than the reference standards, the precedence of the IECC may result in significant impacts. It is beyond the scope of this report to identify and evaluate these potential impacts.
NEW 201.1 (E14-97)	201.1	A definition of **Approved** was added.	Helps code officials evaluate compliance tools while ensuring that sufficient information exists to verify the accuracy and applicability of such tools.
NEW 201.1 (E4-97)	201.1	The definition **Group R Residential Buildings** was deleted. The definitions **Residential Building, Type A-1** and **Residential Building, Type A-2** were revised. A definition of **Commercial Building** was added. Various sections throughout the code were revised to accommodate this new terminology.	No impact, except to improve utility and clarify applicability of the code by creating a singular way to classify building type consistent with model building codes.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
NEW (E42-97)	201.1	A definition of **Heat Trap** was added.	No impact, except that the change assists code officials in applying the heat trap installation requirements (see IECC Section 504.9).
NEW (E43-97)	201.1	Definitions for **Window Projection Factor** and **Economizer** were added.	No impact, except that the change assists code officials in applying the commercial provisions of Chapter 7 of the IECC.
NEW (E15-96)	201.1	A definition of **Degree Day, Cooling** was added.	Helps apply the duct insulation criteria of Table 503.3.3.3.
201.1 (E4-95)	201.1	The following definitions were deleted: C **Building Project** C **Room Cavity Ratio (RCR)**	No impact. These terms are not used in the IECC.
201.1 (E13-96)	201.1	The definition of **Gross Area of Exterior Walls** was revised to provide more specific information about envelope components that are to be considered as walls for building envelope compliance.	Clarifies which portions of the building envelope are subject to the exterior wall provisions of Section 502.2.
201.1 (E14-96)	201.1	The definition of **Roof Assembly** was revised to clarify when a skylight shaft is considered part of the roof.	Skylight shafts of 12 in. or greater in depth must be insulated to R-13 in mild climates and R-19 in cold climates.
Table 302.1 (E15-96)	Table 302.1	An exterior design condition, "Degree Days Cooling," was added. Acceptable sources for degree-day information were expanded.	Allows application of the duct insulation criteria in Table 503.3.3.3.
303.1 (E17-97)	DELETED	This section was deleted to remove ventilation provisions from the scope of the IECC.	Issues of minimum ventilation (natural or mechanical) are no longer addressed in Chapter 3 of the IECC. Note that ventilation is most often addressed by the mechanical code of the adopting jurisdiction.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
NEW (E43-97)	Figs. 302.1(1)-(50)	Maps of all 50 U.S. states showing the climate zones were added for use with Chapter 7, "Design by Acceptable Practice for Commercial Buildings."	Assists in determining the climate-specific requirements for simple commercial buildings (see Chapter 7).
402.1 (E6-95)	402.1.2	The term "Conditioned" was added to describe the applicable floor area of the proposed design.	Clarifies standard design for Chapter 4 comparisons. NOTE: This term was inadvertently left out of the first printing of the IECC.
402.1.1 (E19-97) (E22-97)	402.1.3.4.3	The assumption of 40 ft^2 of door area for the standard design was eliminated. Instead, the door area of the standard design is specified to be equal to the door area of the proposed design. The door *U*-factor is set to be 0.2.	Establishes equal door areas for the standard and proposed designs. May slightly increase stringency of the systems analysis approach because of the 0.2 *U*-factor for standard design doors.
402.1.1 NEW NEW NEW (E16-96) (E18-97) (E21-97) (E22-97)	402.1.1 T402.1.1(1) T402.1.1(2) 402.1.3	Section 402.1.1 was extensively revised to include "alternative" wall, fenestration, and roof/ceiling requirements for the standard design. Window area for the standard design is "specified" as 18% of the floor area. Formerly, these requirements were obtained by reference to Chapter 5. Additionally, the IECC has new specifications that windows in the standard design be distributed equally among eight orientations, with a maximum SHGC of 0.40 in mild climates and 0.68 in colder climates. Interior shading values are now specified. More specific requirements for obtaining credit for reducing duct and envelope leakage were added. The input values that form the basis of the comparison were rewritten and given section references and headings.	Improves the utility and enforcability of the IECC. Provides for greater uniformity among comparative energy analyses because the new "rules" help limit "gaming."

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
NEW (E29-97)	402.1.4	Language was added to clarify the application of the insulating value of adjacent soil-to-foundation systems when using the comparative building thermal envelope analyses established in Chapter 4 and Section 502.2.2.	Reduces the opportunity to "game" these analyses and design a building that does not comply with the IECC because consistent assumptions about heat loss through adjacent soil are now required.
402.5 (E17-96)	402.5 (Exception)	The term, "conditioned floor area," was added to the exception to describe the application of the 5,000 ft^2 or less term. The term, "Heating, cooling and hot water use," was also added to the exception to define the energy-consuming systems to be evaluated.	Eliminates "gaming," wherein unconditioned areas, such as garages, could be included in determining qualification for the exception. Clarifies that all energy-consuming systems shall be included in the comparison required by Sections 402.1.
403.1 403.1.3 403.2 (E7-95)	403.1 403.1.3 403.2	Reference to Section 401 was changed to Section 402 when identifying criteria for designs using renewable energy sources.	No impact, except to provide clarification in identifying systems analysis criteria.
403.2 (E8-95)	403.2 (Exception)	The term, "conditioned floor area," was added to the exception to describe the application of the less than 20,000 ft^2 term. Reference to "residential" buildings in the exception and the last phrase of the exception were deleted.	Eliminates "gaming," wherein unconditioned areas, such as garages, could be included in determining qualification for the exception.
502.1.1 (E19-96) (E24-96)	502.2.2	The term, "thermal transmission," was added to describe the basis of the comparison in the heat gain or heat loss analysis. A reference to the ASHRAE Handbook of Fundamentals was added to provide guidance to users for slab-edge and basement or crawl space wall heat gain/loss calculations (ASHRAE 1997).	Clarifies that total conduction (i.e., "thermal transmission") through the building envelope is the basis of the comparison.
502.1.2 (E10-95)	502.1.1	The terms used in the equation to determine a wall's heat capacity were expanded to clarify that the wall's heat capacity is based on the wall's exterior surface area.	Clarifies how the heat capacity of a wall is calculated.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
502.2 (E25-97)	502.2	This section was revised to clarify that trade-offs involving space-conditioning equipment, service water-heating equipment, and/or lighting must be done using Chapter 4. (The code's lighting requirements are only for public areas of multifamily buildings.)	The change limits compliance options using equipment/envelope energy measure trade-offs to only the procedures established by a systems analysis approach (Chapter 4). Trade-offs allowed in Chapter 5 are limited to envelope measures. Trade-offs involving equipment must be done using Chapter 4. Note that any compliance tool could be approved by the building official under Section 103.
Table 502.2.1a NEW 502.2.4 (E23-96) (E34-97)	Table 502.2 Fig. 502.2(7) 502.2.1.4	A footnote 'd' was added to clarify that slab-edge insulation in areas of "very heavy termite infestation" is not required. A U.S. map depicting "termite infestation probability" was added. Section 502.2.1.4 of the IECC was revised to clarify that where slab-edge insulation is not used because of termites, the envelope compliance methods in Sections 502.2.2 and 502.2.4 or Chapter 4 must be used and the user must account for the shortfall in the slab-edge insulation.	Where slab-edge insulation is required but not installed, this shortfall must be accounted for elsewhere through other energy efficiency improvements.
Table 502.2.1a (E28-97)	Table 502.2	Footnote 2 in the 1995 MEC was deleted.	No impact. This footnote had text about wall requirements below 500 HDD that were unnecessary because these requirements are already detailed in the figures referenced by this table.
Figure 3 (E34-97)	Fig. 502.2(3)	Footnotes 1 and 2 and the table associated with Figure 3 were deleted.	No impact, except to clarify the application of Table 502.2, Footnote 'd'. Provisions regarding the installation of slab insulation are addressed in the footnotes of Table 502.2 and Section 502.2.1.4.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
502.1 T502.2.1b (E32-97)	502.2.1.1 Table 502.2.1.1	The term, "metal," when referring to wall framing was replaced by the term, "steel." The "gage of stud" category was also deleted.	No impact, except to clarify and ensure consistency with model building codes and standards of industry.
NEW (E27-97)	502.2.4	A new section was added creating a fourth method of thermal envelope compliance for residential buildings, "Compliance by Prescriptive Specification on an Individual Component Basis." This change adds a set of tables with insulation *R*-value and glazing *U*-factor requirements for 17 U.S. zones based on HDD. There are six tables for Type A-1 Residential Buildings and three tables for Type A-2 Residential Buildings. Each table addresses a different window area: 8, 12, 15, 18, 20, and 25 percent for Type A-1; 20, 25, and 30 percent for Type A-2.	Improves the usability and enforcability of the IECC by adding tabulated envelope compliance requirements.
502.2.2 (E14-96)	502.2.1.2	This section was revised to specify that skylight shafts be insulated to R-13 in mild climates and R-19 in cold climates.	Increases stringency of the IECC, presuming that skylight shaft walls were previously left uninsulated.
502.2.2 (E29-97)	502.2.2	Language was added to clarify the application of the insulating value of adjacent soil-to-foundation systems when using the comparative building thermal envelope analyses established in Chapter 4 and Section 502.2.2.	Reduces the opportunity to "game" these analyses to comply with the IECC because consistent assumptions about heat loss through adjacent soil are now required.
502.2.2 502.2.3 (E20-96)	502.2.1.2 502.2.1.3	Provisions for access openings in floor and roof/ceiling envelope components were added.	Helps to assure that access openings are accounted for when performing heat loss/gain calculations.
502.3 502.3.1 502.3.2 (E25-96)	502.3 502.3.1 502.3.2	This section was revised to remove multiple redundancies in language, including a restatement of the scope of the code, and reiteration of the thermal boundary defined by the term "building envelope" and the sealing of joints.	Improves the utility of the code when inspecting for caulking, sealants, and other methods to seal air leaks.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
T502.3.2 (E36-97)	T502.3.1	The table was revised to reflect the replacement of several referenced window standards with a single, unified window standard, *AAMA/NWWDA 101-97* (AAMA/NWWDA 1997). New allowable air infiltration rates were established consistent with the updated reference standards.	Marginal potential reduction in allowable air infiltration rates for manufactured fenestration products.
NEW (E37-97)	502.4	Provisions were added establishing a maximum SHGC requirement of 0.4 for fenestration in locations with HDD less than 3,500.	Improves energy efficiency in residential construction by establishing limits to solar heat gain through fenestration in climates that generally have high cooling energy loads.
Section 503 (E27-96)	Section 503	This section was revised to reflect only those requirements specific to residential buildings. Provisions and referenced standards specific to mechanical systems and equipment found in commercial buildings are provided by reference to the ASHRAE 90.1 Code as adopted by reference in Chapter 6.	Improves the utility of the code by removing commercial provisions from residential requirements and by providing clearer language.
503.3.3.2 (E27-96)	503.3.2.3	Provisions preventing heat pump supplementary electric resistance heater operation were added to restrict supplemental heater operation to defrost cycles.	It is unclear whether improvements in energy efficiency would be achieved through the limitations placed upon heat pump supplemental heater operation.
T503.7.1 (E29-96)	T503.3.3.3	The "Duct Location" descriptor and Footnote 4 were revised to clarify that duct insulation criteria also apply to ducts located within exterior walls of the building envelope. The requirement that ducts inside the building envelope be insulated was deleted. The description of "uninsulated spaces" was expanded.	May lead to improvements in energy efficiency, assuming that ducts located within building envelope components were previously not addressed through the inspection process.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
503.8 503.8.1 503.8.2 (E41-97)	503.3.3.4	Language and referenced standards were added clarifying duct construction, installation, and sealing criteria.	Improves the utility of the code by reference to the proper standard and installation criteria (see Chapter 8 of the IECC), and assists with field inspection tasks. Language is generally consistent with the ICC *International Mechanical Code* (ICC 1996).
503.8.2 (E32-96)	503.3.3.4	This section was revised to require ducts "...not located entirely within conditioned space," to be sealed. Previously, all supply and return ducts were required to be sealed regardless of location.	Recognizes that distribution losses (i.e., duct leakage) to and from the conditioned space are acceptable.
Table 504.2 (E34-96)	Table 504.2	The referenced standard for pool heaters was corrected to *ANSI Z21.56-1989* (ANSI 1989). For "Other water heating equipment, Storage/instantaneous, Gas/oil," the input value range was corrected.	Improves the utility of the code by referencing the proper installation standard.
504.2.1.1 504.2.1.2 (E35-96)	DELETED	The provisions in these sections were deleted consistent with (E91-94). Table 504.2 contains these performance criteria in a more readable format.	Eliminates duplicated performance criteria found in Table 504.2.
504.2.2 (E12-95)	DELETED	This section was deleted.	Eliminates duplicated performance criteria found in Table 504.2.
NEW (E42-97)	504.9	Provisions requiring heat traps for storage hot water tanks with vertical risers in noncirculating systems or storage tanks without integral heat traps were added.	Improves energy efficiency by preventing the cooling of resident hot water in service water heaters through thermosyphoning.

Table 1. (cont'd)

1995 MEC Section	1998 IECC Section	Description of Change	Comments
Chapter 6 (E18-96)	502.2.3	Provisions in Chapter 6 that were redundant with provisions in Chapter 5 were deleted while unique criteria in Chapter 6 were simultaneously relocated to Section 502. Section 502 was then rearranged to address the four paths to envelope compliance [i.e., envelope compliance based on 1) a component basis, 2) building envelope performance, 3) acceptable practice, or 4) prescriptive specification] in a consolidated location.	Simplifies the code; more logical presentation.
T602.2.1c T602.2.5 T602.2.6 (E35-97)	Tables 502.2.3.1(3), 502.2.3.5, and 502.2.3.6	Insulated concrete form (ICF) system details were added to the acceptable practice provisions of Section 502.2.3.	Improves the utility of the IECC when evaluating thermal envelope compliance of ICF systems.
702 (E37-96)	DELETED	This section was deleted.	No impact because Chapter 6 of the IECC already specifies the appropriate requirements for commercial buildings, including the systems analysis and energy cost budget methods.
NEW (E43-97)	Chapter 7; Chapter 3 (climate maps)	An entirely new chapter was added to provide commercial building energy code requirements for "simple" commercial buildings. Requirements are equivalent to the 90.1 Code adopted by reference in Chapter 6. "Simple" commercial buildings are buildings no greater than three stories in height above grade; having no more than 40% glazing area in above-grade walls; served by unitary or packaged HVAC equipment each serving one zone; and equipped with "simple" lighting system schemes, controls, and equipment (i.e., no daylighting).	Improves the utility and enforcability of the IECC when evaluating small- to medium-sized commercial buildings with "simple," single-zone mechanical systems. For buildings having greater than four stories in height, greater than 40% glazing area, or "complex" mechanical or lighting system arrangements, compliance must be evaluated by the more flexible and technically sophisticated 90.1 Code, adopted by reference in Chapter 6.

1995 MEC Section	1998 IECC Section	Description of Change	Comments
801.1 (E15-97)	107.1	The section that establishes the precedence of referenced standards was relocated to the administrative chapter of the code (Chapter 1).	No impact, except to establish the precedence of standards referenced by the code in a manner consistent with that of other International Codes.
801.1 (E41-96) (E10-97) (E36-97)	Chapter 8	Referenced standards *NAIMA-94* (NAIMA 1994), *NFRC 100-97* (NFRC 1997), and *AAMA/NWWDA 101-97* (AAMA/NWWDA 1997, previously RS-48) were updated to the most current versions.	Maintains current standards with latest construction practices and test standards.
801.1 (E7-96) (E31-96) (E38-96) (E41-96) (E22-97) (E41-97)	Chapter 8	Referenced standards *NFRC 200-95* (NFRC 1995), *NAIMA-94* (NAIMA 1994), *SMACNA-85* (SMACNA 1985), *ASHRAE 136-93* (ASHRAE 1993a), *UL 181-96* (UL 1996), *UL 181A-94* (UL 1994), and *UL 181B-95* (UL 1995) were added.	Improves the utility of the code by referencing the proper standard and installation criteria, and assists with field inspection tasks.
801.1 (E39-96) (E18-97) (E36-97)	Chapter 8	Referenced standards RS-8, RS-9, RS-46, RS-49 and RS-50 were deleted. NOTE: Final Action on (EC17-97) removed ventilation provisions from the scope of the IECC in their entirety. While the IECC definition of **Ventilation Air** still retains a reference to *ASHRAE Standard 62-1989* (ASHRAE 1989b), definitions do not evoke code requirements. The reference is only included to define the IECC terminology with respect to the term “Outdoor air” as defined by the ASHRAE standard.	No impact because the 1998 IECC no longer refers to or requires a reference to these standards. For RS-3, *ASHRAE Standard 62-1989* (ASHRAE 1989b) issues of minimum ventilation (natural or mechanical) are addressed in Chapter 4 of the ICC *International Mechanical Code* (ICC 1996).
802 (E42-96)	Chapter 8	The names and addresses of various standards promulgating organizations were revised to eliminate agencies whose standards are no longer referenced, and to include those agencies who sponsor standards referenced by the IECC.	Improves the utility of the code by reference to the proper standards promulgating organizations, and assists with field verification.

3.0 REFERENCES

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Underwriters Laboratories Inc. (UL). 1994. *UL 181A-94*, "Closure Systems for Use with Rigid Air Ducts and Air Connectors." Northbrook, Illinois.

Underwriters Laboratories Inc. (UL). 1995. *UL 181B-95*, "Closure Systems for Use with Flexible Air Ducts and Air Connectors." Northbrook, Illinois.

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APPENDIX

ERRATA TO THE 1998 INTERNATIONAL ENERGY CONSERVATION CODE

November, 1999

Update your copy of the International Energy Conservation Code by correcting the items identified below.

FIRST PRINTING

Page

17b Add new **Figure 302.1(8b), DISTRICT OF COLUMBIA**, Climate Zone 10b.

61 **402.1.2 Proposed design.** Revise to read as follows: "...it shall utilize the same energy source(s) for the same functions and have equal conditioned floor area..."

66 **Tables 502.1.1(1)-(3).** Revise column heading to read as follows: "U_w REQUIRED FOR WALLS WITH A HEAT CAPACITY LESS THAN 6 Btu/ft.^{2} @ EF. AS DETERMINED BY USING EQUATION 5-1 AND FIGURE 502.2(1)"

66 **Tables 502.1.1(1)-(3).** Revise unit conversion to read as follows: "1 Btu/ft.^{2} @ EF. = 176 J/(m ^{2} @ K)."

75 **502.2.3.3 Floors over unheated spaces.** Revise last sentence to read as follows: "For floors over outdoor air, i.e., overhangs, U_o-values for heating shall meet the same requirement as shown for roof/ceilings in Table 502.2."

75 **502.2.3.5 Crawl space walls.** Revise first sentence to read as follows: "If the floor above a crawl space does not meet the requirements of Section 502.2.3.3, and the crawl space does not have ventilation..."

75 **502.2.4 Compliance by prescriptive specification on an individual component basis.** Revise last sentence to read as follows: "Sections 502.2.4.1 through 502.2.4.14 shall apply to the use of these tables."

76 **502.2.4.13 Tables not applicable.** Revise to read as follows: "...shall not be used with the indicated envelope component(s) to demonstrate compliance under Section 502.2.4.

77 **Table 502.2.4(2).** Revise tabular entry for "Ceiling R-value," 7,000-8,499 HDD to "R-49."

79-80 **Tables 502.2.4(7)-(9).** Revise tabular range under "Heating Degree Day" from HDD 3,000-3,400 to HDD 3,000-3,499.

84 **Table 504.2.** Revise unit conversion to read as follows: "1 gallon = 3.785 L."

135 Revise Title of **NAIMA-94** to read as follows: "Fibrous Glass Duct Liner Construction Standards."