

## **Differences Between the 1993 and 1995 CABO Model Energy Codes**

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## Foreword

This report is one in a series of documents describing research activities in support of the U.S. Department of Energy (DOE) Building Standards and Guidelines Program. The Pacific Northwest Laboratory (PNL) leads the program for DOE. The goal of the program is to develop and encourage the implementation of performance standards to achieve the maximum practicable energy efficiency in the design of new buildings. Such standards are required of DOE by Title III of the Energy Conservation and Production Act (42 USC 6831 et seq.) as amended by the Energy Policy Act of 1992 (Public Law 102-486).

The program approach to meeting the goal is to initiate and manage individual research and standards and guidelines development efforts that are planned and conducted in cooperation with representatives from throughout the buildings community. Projects under way involve practicing architects and engineers, professional societies and code organizations, industry representatives, and researchers from the private sector and national laboratories. Research results and technical justifications for standards criteria are provided to standards development and model code organizations and to Federal, State, and local jurisdictions as a basis to update their codes and standards. This effort helps to ensure that building standards incorporate the latest research results to achieve maximum energy savings in new buildings, yet remain responsive to the needs of the affected professions, organizations, and jurisdictions. Our efforts also support the implementation, deployment, and use of energy-efficient codes and standards.

This report identifies the differences between the 1993 (CABO 1993) and 1995 (CABO 1995) editions of the Council of American Building Officials (CABO) Model Energy Code (MEC) and briefly highlights the technical and administrative impacts of these changes.

Readers with questions, comments, or suggestions about this document or the work it describes are encouraged to contact the author(s), program managers, or project managers.

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## Summary

The Energy Policy Act of 1992 (Public Law 102-486, 16 USC 1531 et seq., as amended) requires the U.S. Department of Energy (DOE) to determine if changes to the Council of American Building Officials' (CABO) 1993 Model Energy Code (MEC) (CABO 1993), published in the 1995 edition of the MEC (CABO 1995), will improve energy efficiency in residential buildings.<sup>(a)</sup> The DOE, the states, and others have expressed an interest in these differences.

To help the states and others identify and understand the impact of the changes to the 1993 MEC, DOE tasked the Pacific Northwest Laboratory<sup>(b)</sup> with identifying those changes and their impacts.

The MEC is revised annually. For example, proposed code changes considered and approved during 1993 are published in the 1994 amendments (CABO 1994) to the 1993 edition of the MEC (CABO 1993). The 1994 amendments and changes approved during 1994 are published in the 1995 edition of the MEC (CABO 1995). To fully understand all changes, a copy of the 1993 MEC, the 1994 amendments, and the 1995 MEC is required.

The significant changes considered and approved in 1993 and incorporated in the 1994 amendments are listed below.

Some section numbers in the 1995 MEC have changed relative to the 1993 MEC because provisions have been added and deleted.

The 1994 amendments eliminate provisions applicable only to nonresidential buildings because adoption of *ASHRAE/IES Standard 90.1-1989* (ASHRAE 1989a) by reference (during the 1992 code-change cycle) for those buildings make their continued presence in the MEC moot.

The 1994 amendments add provisions that clarify the conditions for and basis of the building performance analysis in Chapter 4.

The 1994 amendments add provisions to limit heat loss and air infiltration through recessed lighting fixtures located in the building envelope.

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- (a) Residential buildings are considered to include one- and two-family dwellings, townhouses, rowhouses, and multifamily residential structures less than or equal to three stories in height. All other buildings are considered commercial buildings (including hotels, motels, and high-rise multifamily buildings) for the purpose of this report.
  - (b) Pacific Northwest Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.



The significant changes considered and approved in 1994 and incorporated in the 1995 edition of the MEC are listed below.

The 1995 MEC adds a reference to the National Fenestration Rating Council (NFRC) standard for thermal properties of glazing assemblies and provides default values for products not evaluated to the NFRC standard (NFRC 1991).

The 1995 MEC includes additional details prescribing the Chapter 4 analysis related to infiltration, duct location, window shading, and foundation type consistency.

The 1995 MEC adopts the *Energy Code for Commercial and High-Rise Residential Buildings - Codification of ASHRAE/IES 90.1-1989* (ASHRAE 1993a) by reference in place of the current reference to *ASHRAE/IES Standard 90.1-1989* (ASHRAE 1989a).

The 1995 MEC adds criteria to specifically correct for metal stud framing in wall thermal calculations.

The 1995 MEC eliminates the potential for insulating the walls of a ventilated crawl space rather than the floor above.

The 1995 MEC enhances the air-infiltration provisions related to caulking and sealing.

The 1995 MEC strengthens the duct-sealing provisions and applies them to all supply and return ducts.

The 1995 MEC has, as a reference standard, the *1993 ASHRAE Handbook--Fundamentals* (ASHRAE 1993b) in place of the *1989 ASHRAE Handbook--Fundamentals* (ASHRAE 1989b). For calculating wood-frame wall U-factors (U-values), the 1993 handbook directs users to assume a higher fraction of the wall area is framing.

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## 1.0 Introduction

The Energy Policy Act of 1992 (Public Law 102-486, 16 USC 1531 et seq., as amended) requires the U.S. Department of Energy (DOE) to determine if changes to the Council of American Building Officials' (CABO) 1993 Model Energy Code (MEC) (CABO 1993), published in the 1995 edition of the MEC (CABO 1995), will improve energy efficiency in residential buildings.<sup>(a)</sup> The DOE, the states, and others have expressed an interest in the differences between the 1993 and 1995 editions of the MEC.

To help the states and others identify and understand the impact of the changes to the 1993 MEC, the DOE tasked the Pacific Northwest Laboratory with identifying those changes and their impacts.

Section 2.0 of this report describes each change to the 1993 MEC, published in the 1995 MEC, and its impact. Referenced publications are listed in Section 3.0.

The Appendix lists discrepancies between code changes approved in the 1994 and 1995 code-change cycles and what actually appears in the 1995 MEC.

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(a) Residential buildings are considered to include one- and two-family dwellings, townhouses, rowhouses, and multifamily residential structures less than or equal to three stories in height. All other buildings are considered commercial buildings (including hotels, motels, and high-rise multifamily buildings) for the purpose of this report.

## **2.0 Changes to 1993 MEC Published in 1995 MEC**

Most of the changes to the 1993 MEC, contained in the 1995 MEC, are minor. Some changes will improve energy efficiency. Some section numbers changed because provisions were added or deleted. All changes are described in Table 1 in *very* general terms to provide an overview of the changes and their impacts. To fully understand all changes, a copy of the 1993 MEC, the 1994 amendments, and the 1995 MEC is required.

The MEC is revised annually. For example, proposed code changes considered and approved during 1993 are published in the 1994 amendments to the 1993 edition of the MEC. The 1994 amendments and changes approved during 1994 are published in the 1995 edition of the MEC. Revisions contained in the 1994 amendments are identified in Table 1 as "(94)" (though they also appear in the 1995 edition) and those in the 1995 edition are identified as "(95)."

**Table 1.** Changes to 1993 MEC Published in 1995 MEC

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
101.2 (94) <sup>(a)</sup>	The last sentence of the second paragraph that introduces the various ways to comply is deleted. The compliance paths are placed in a new Section 101.3, combining those for residential buildings (Chapters 4, 5, and 6) in one statement and those for other than residential buildings (Chapter 7) in another statement. A third statement comprises the existing statement about abridging other requirements, codes, or ordinances.	No impact, except to allow Chapter 1 to present the material more appropriately.
101.3 (94)	This section is renumbered as Section 101.4 and clarifies that residential buildings must meet Chapters 4, 5, or 6 and other buildings must meet Chapter 7.	No impact, except to clarify chapter applicability by building type.
101.3.1 (94)	This section is renumbered as Section 101.4.1 and the words "shall be regulated by Chapter 7" are deleted from Section 101.3.1.2.	No impact because the requirement for other buildings to meet Chapter 7 is contained in Section 101.3 (compliance) of the 1994 amendments.
102.1.1 (95) <sup>(b)</sup> New 102.1.2 (95) New 102.1.3 (95)	These sections add new provisions to identify insulation thermal resistance and mark the installed thickness of sprayed or blown insulation.	Helps inspectors perform insulation inspections and verify code compliance in the field.
New 102.3 (95)	This section adds new provisions to require that fenestration product U-values be determined in accordance with <i>NFRC 100-91</i> (NFRC 1991) or through a default table of U-values for windows, doors, and skylights.	Makes compliance easier to determine and assists with field verification during construction. Will possibly increase the stringency of the code by securing more accurate and realistic thermal properties.

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(a) Revisions contained in the 1994 amendments to the 1993 MEC (also will appear in the 1995 MEC).

(b) Revisions contained in the 1995 MEC (not contained in the 1994 amendments).

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
104.1 (95)	An exception is added stating that anyone having qualifications acceptable to the building official can prepare a Chapter 4 design for one- and two- family dwellings and multifamily buildings $\leq 5000$ ft <sup>2</sup> in floor area.	Allows those who are not licensed architects/engineers to perform the calculations specified in Chapter 4.
201.1 (94)	<p>The following definitions are deleted:</p> <p><b>Coefficient of beam utilization (CBU)</b>  <b>Coefficient of utilization (CU)</b>  <b>Color rendition</b>  <b>Equivalent sphere illumination (ESI)</b>  <b>Floodlighting</b>  <b>Illumination</b>  <b>Light loss factor (LLF)</b>  <b>Luminaire</b>  <b>Public facility rest room</b>  <b>Reflectance</b>  <b>Veiling reflections</b>  <b>Work plane</b></p>	No impact because these terms apply to criteria for other than residential buildings, which were deleted in the 1993 MEC as a result of adopting <i>ASHRAE/IES Standard 90.1-1989</i> by reference (ASHRAE 1989a).
201.1 (95)	A definition of <b>Annual fuel utilization efficiency (AFUE)</b> is added.	Facilitates the application and verification of efficiency requirements in Tables 503.4.3a and 503.4.3c.
201.1 (95)	The definition of <b>Basement wall</b> is revised to refer to the enclosure of <i>one side</i> of a basement.	Clarifies that walls below grade must be considered separately, as opposed to the aggregate, when determining if they are subject to Sections 502.2.1 or 502.2.6.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
201.1 (95)	<p>The definition of <b>Gross wall area</b> is revised to refer to <i>each</i> basement wall.</p> <p>The definition of <b>Gross wall area</b> is revised to refer to exterior walls and to include certain interior walls that are part of the building envelope.</p>	<p>Clarifies that the area of walls below grade must be considered for each separate wall, as opposed to the aggregate, when determining if they are subject to Sections 502.2.1 or 502.2.6.</p> <p>Helps clarify what portions of the building envelope are subject to the wall provisions of Section 502.2.1 and what portions are subject to the basement provisions of Section 502.2.6.</p>
201.1 (95)	The definition of <b>Service water heating</b> is revised by deleting "domestic or commercial."	No impact because the purpose for providing hot water (i.e., domestic or commercial) has no bearing on the MEC requirements.
201.1 (95)	The definition of <b>Slab-on-grade floor insulation</b> is revised to clarify that it applies to the slab <i>perimeter</i> when the top edge is above grade or 12 in. or less below grade.	Adds requirement for insulation on slabs below grade that previously did not require insulation.
201.1 (95)	A definition of <b>Glazing area</b> is added.	Helps apply the thermal requirements in the MEC.
201.1 (95)	A definition of <b>Sash crack</b> is added.	Helps apply the air-infiltration limitations for windows.
201.1 (95)	A definition of <b>Thermal resistance, overall (Ro)</b> is added.	No impact because the term is not used in the MEC.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
301.1 (95)	The scope of Chapter 3 is revised to clarify its application to design conditions for use with Chapters 4, 5, and 6.	No impact, except to ensure that design conditions for buildings covered by Chapter 7 (commercial) are obtained from <i>ASHRAE/IES Standard 90.1-1989</i> , which is adopted therein by reference (ASHRAE 1989a).
302.1 (95)	A footnote is added to specify acceptable sources for degree-day information.	Improves the adoptability and usability of the MEC. Eliminates potential conflicts with acceptance of heating degree-day data.
401.1(95)	The term "Group R" is deleted when describing residential buildings.	No impact, except to provide consistency in describing residential buildings, which are defined in Section 201.1.
402.1 (94)	"Proposed" is added in the last paragraph to describe an alternate building.	Clarifies that the alternate building to the "standard design" is the proposed building.
New 402.1.1 (94)	A detailed list of input values for calculating annual energy performance is added. This list indicates the variables that must be constant between the standard and proposed designs and specifies default values of acceptance ranges for others.	Reduces the opportunity to "game" the analyses and design a building that does not comply with the MEC.
402.1.1 (95)	The references to a blower door test for air infiltration are changed, and ducts located within a space containing a positive heat supply must be considered in an inside location.	Clarifies that the reference only applies to a blower door test and not other air-infiltration-reduction measures. Clarifies the ducts that are considered inside.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
402.1.1 (95)	An equation for adjusted efficiency to consider the energy impacts of ducts in inside and outside locations is added.	Only a clarification because the intent for proportionally addressing ducts in inside and outside locations was already implied in the MEC text.
402.1.1 (95)	The air-infiltration rate for the standard design was reduced from 0.67 air changes per hour (ACH) to 0.51 ACH.	Increases the stringency of the MEC because the basis for any air-infiltration-reduction "credits" has been lowered 0.16 ACH.
402.1.1 (95)	The specification for shading of the standard design is modified to assume draperies are closed during <i>mechanical</i> air conditioner operation. A criterion that the standard design not have added exterior shading beyond typical construction practice and that any actual installations in the proposed design be verified by the building official is added.	Encourages the use of shading, based on the assumption that all glazing is unshaded. Alternatively, this change may allow for "free riders" who would not have assumed unshaded glazing and will now get a "free credit" with which to adjust some other aspect of the design to be less energy efficient than it otherwise would have been.
402.1.1 (95)	A requirement that the foundation and floor type in the standard and proposed design must be the same is added.	Eliminates "gaming," wherein an inefficient standard design is established as a basis for securing an unwarranted "credit."
New 402.4.1 (95)	A criterion is added that the same calculational tool be used to estimate annual energy use for heating and cooling standard and proposed designs and that the tool be approved by the building official.	Clarifies that the same calculational tool must be used to eliminate "gaming."
402.5 (95)	This section is revised to clarify that the full-year analysis is described in Sections 402.3 and 402.4.	No impact.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
403.1.1 (94)	The requirement that windows be shaded "during periods when cooling is required" is revised to "during periods when <i>mechanical</i> cooling is required."	Excludes those nonmechanical cooling situations, such as evaporative cooling.
New 403.1.2 (94)	An exclusion is added for solar energy through windows when the glass 1) has certain characteristics and 2) is shaded when mechanical cooling is required.	Allows certain windows to qualify for a solar "credit" that previously was not specifically allowed.
403.2 (95)	The term "structure" is changed to "building" in the exception.	Provides consistent terminology.
501.1 (95)	The reference to Group R residential buildings is deleted and the section requires that Group R residential buildings be designed to meet Chapter 5.	No impact, except to provide consistency in referring to residential buildings and to clarify that the scope of Chapter 5 applies to items beyond thermal performance.
502.1.1 (94)	The last sentence of Section 502.1.1, referring to Figure No. 7 of Chapter 8, is deleted. Figure No. 7 is deleted as well.	No impact, except to eliminate a graphic method of trading wall and roof/ceiling thermal transmittance.
502.1.2 (95)	This section is revised to clarify that the thermal mass credit only applies to exterior walls covered by Section 502.2.1.	No impact, except to clarify the limits of the thermal mass credit.
502.1.4 (95)	The term "used" is changed to "installed" when referring to vapor retarder installation.	No impact, except to use a more appropriate term.
502.2.1 (95)	Provisions are added to specifically correct wall thermal properties for walls with metal stud framing. This provision includes an equation to determine $U_w$ and factors to correct cavity insulation for the effects of the framing.	Assigning a thermal value to metal stud framing provides more accuracy in the treatment of metal stud framing because the 1993 MEC was not specific in this area.
502.2.1 (95) 502.2.2 (95) 502.2.3 (95)	The part of the first sentence that defines the scope as a heated or <i>mechanically</i> cooled residential building is deleted.	No impact because this definition is already provided in the MEC.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
502.2.3 (95)	Equation 3 is added to prescribe the calculation of a floor $U_o$ value.	Improves use of the MEC because no calculational procedure was provided in the 1993 MEC.
502.2.4 (95) 602.2.4 (95)	The provisions are revised to require that insulation be placed on the outside of the foundation or on the inside of the foundation wall. A provision is also added that the insulation must extend from the top of the slab to the bottom of the slab or downward and then horizontally to the interior or exterior for a required distance (the same as in the 1993 MEC). Insulation placed horizontally outside the foundation must have at least 10 in. of cover.	Allows placement of insulation outside the perimeter of the slab.
502.2.5 (95)	This section is revised to require that crawl spaces vented to the outside have floors insulated according to requirements in Section 502.2.3. The ventilation criteria are deleted.	Will not allow crawl spaces vented to the outside to have insulated walls because the ventilation openings "bypass" the insulation system. Disallows an ineffective method of insulating ventilated crawl spaces.
New 502.2.7 (95) New 602.2.7 (95)	A provision is added to exclude the horizontal portion of a foundation supporting masonry veneer from being insulated.	Clarifies the insulation of this envelope detail and eliminates the impracticality of insulating this area.
502.3.1 (95)	This section is revised to clarify that the air-leakage provisions also apply to the separation of interior spaces from exempt portions of buildings.	Increases energy efficiency, assuming these assemblies were not previously addressed.
Table 502.3.2 (94)	Window and door standards are redesignated as separate individual referenced standards (RSs) rather than listed under one RS group.	No impact, except to provide a clearer indication of the applicability of the RSs.
502.3.3 (95)	The text addressing the sealing of potential sources of air leakage in the building envelope is rearranged and reworded.	No impact, except to provide clearer language.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
502.3.3 (95)	The term "conditioned" is deleted when referring to building envelope.	No impact, except for editorial clarification.
Equation 1 (95)	Terms used in the definitions of variables are changed for consistency with other code provisions.	Promotes code consistency and eliminates a potential conflict in distinguishing between exterior walls and basement walls.
Equation 1 (95)	"Glazing area" is changed to "area of all windows within the gross wall area" and "skylight area" is changed to "area of all skylights in the roof-ceiling assembly." A provision that attic access doors be included as part of the roof/ceiling assembly is added.	Allows consideration of the entire assembly, not just the glass, in thermal calculations.
New 502.3.4 (94) New 602.3.3 (94)	These sections add provisions for recessed lighting fixtures to limit associated heat loss and air infiltration when they are installed in the building envelope.	Reduces heating and cooling energy use and ventilation attributable to air infiltration.
503.1 (94)	The exception for special applications is deleted.	No impact because the listed applications are not found in the residential buildings to which Chapter 5 applies.
503.3 (94)	This section is deleted.	No impact because systems that simultaneously heat and cool are extremely rare in the residential buildings to which Chapter 5 applies.
Table 503.3.3c (95)	This table is retitled to clarify that boilers are <i>steam and hot water</i> .	Clarifies the scope of the provisions.
503.4.4 (94)	The last two sentences covering damper leakage are deleted.	No impact because the lack of a standard for damper leakage makes it difficult to evaluate the deletion of a requirement for "tight" dampers.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
503.4.4, Exception 1 (94)	This exception is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for this exception moot.
503.4.5.1, Exception (94)	This exception is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for this exception moot.
503.7 (94)	This section is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for the provisions in this section moot.
503.8.3.3 (94)	The beginning of first sentence of the first paragraph and the entire second paragraph are deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for these provisions moot.
503.9.1, Exception 1 (94)	The reference to one- and two-family dwellings is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for the deleted words moot.
503.10.2 (95)	This section is rewritten to require mastic with fibrous backing on all supply and return ducts. Duct tape is not allowed, and pressure-sensitive tape is allowed on fibrous ducts.	Increases energy efficiency by reducing duct losses and applying these criteria to all ducts instead of only supply ducts located outside the conditioned space.
503.10.3 (94)	This section is deleted.	No impact because the lack of a standard for damper leakage makes it difficult to evaluate the deletion of a requirement for "tight" dampers.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
504.1 (94)	The term "residential," describing refrigerators in the last sentence, is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for this term moot.
504.2.1 (95)	The water-heater-efficiency provisions are rewritten to be consistent with <i>ASHRAE/IES Standard 90.1-1989</i> (ASHRAE 1989a).	Provides consistency with Federal law.
504.8 (95)	Provisions for shower flow are deleted.	No impact because these provisions are covered under Federal law.
504.8.2 (94)	This section is deleted.	No impact because the applicability of Chapter 5 to residential buildings makes the need for the provisions in this section moot.
505 (94)	This section is deleted. The metering provisions in Section 505.2 of the 1993 MEC are renumbered to Section 505.1 in the 1995 MEC. <i>ASHRAE/IES Standard 90.1-1989</i> is referenced for other than the dwelling portion of multifamily residential buildings (ASHRAE 1989a). The code previously contained a codified version of the lighting power provisions of a previous ASHRAE standard.	Reduces energy use attributable to applying <i>ASHRAE/IES Standard 90.1-1989</i> (ASHRAE 1989a) instead of <i>ANSI/ASHRAE/IES Standard 90A-1980</i> (ASHRAE 1980) to the lighting systems and equipment in the nondwelling areas associated with multifamily residential buildings.
505.1 (95)	The provisions of this section are editorially revised to clarify their applicability to multifamily dwellings.	No impact, except to provide an improved understanding of the MEC.
601.1 (94)	The second sentence in this section is deleted.	No impact because the language was redundant.
602.1 (95)	The second paragraph of Section 602.1 is deleted.	No impact because the language was not relevant to the Chapter 6 compliance approach.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
602.2.1 (94) Charts 602.2.1a through 602.2.1f (94)	The charts are deleted and replaced with an equation to facilitate "balancing" opaque wall and glazing thermal properties and areas within the $U_o$ limitation in the code. A simplified approach for considering door area is included.	Provides a simplified way to use the MEC by using data directly applicable to the design rather than using charts that may not address all design options, especially for window thermal properties.
602.2.1 (95)	A reference to new Section 102.3 to determine fenestration U-value is added.	Makes compliance easier to determine and assists with field verification during construction.
602.2.1 (95)	An exception is added that requires the use of metal stud framing correction factors in calculating the opaque wall U-value.	Provides more accuracy in the treatment of metal stud framing because the 1993 MEC was not specific in this area.
602.2.1 (95)	The text is revised to refer to the $U_o$ of the <i>gross area</i> of exterior walls.	Provides clarification and consistency with Section 502.2.1.
Table 602.2.1a (95)	More wall options for cavity insulation and sheathing are added, and $U_w$ values are shown to three decimal places.	Increases accuracy and enhances ability to use Chapter 6.
602.3.2 (95)	The provisions in this section are deleted and a reference to Section 502.3.3 is added.	Eliminates duplicated language in Sections 502.3.3 and 602.3.2.
701.1 (94)	This section is revised to clarify that buildings other than residential buildings (as defined in the MEC) must meet Chapter 7.	No impact, except to provide clarification.
701.1 (95)	The <i>Energy Code for Commercial and High-Rise Residential Buildings - Codification of ASHRAE/IES 90.1-1989</i> (ASHRAE 1993a) is adopted by reference in lieu of <i>ASHRAE/IES Standard 90.1-1989</i> (ASHRAE 1989a), and the reference to residential buildings as Group R is deleted.	Improves ability to implement energy-conservation requirements for commercial buildings.

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
801.1 (94)	The reference to ASTM E779-87 (ASTM 1987) on determining air-leakage rate by fan pressurization is added because it is newly referenced in Chapter 4 as a basis for infiltration reduction "credits."	Reduces the opportunity to "game" the analyses and design a building that does not comply with the MEC.
801.1 (94)	Window and door standards are redesignated from one grouping (RS-2) to individual RS numbers (RS-48 through RS-53).	No impact, except to provide a clearer indication of the applicability of the RSs.
801.1 (95)	RS-1, 2, 4, 7, 14, 21, 28, 33, and 37 are updated to the most current versions of these reference standards.	<p>It is beyond the scope of this report to evaluate the impacts associated with adopting revised standards. The differences between the previous and new editions of the standards and how those differences relate to the context of the MEC reference to the standard would have to be evaluated.</p> <p>One change in updating standard RS-1 to be the 1993 Edition of the <i>ASHRAE Handbook--Fundamentals</i> (ASHRAE 1993b) is that the 1993 handbook lowers the wall area fraction that is the cavity between the framing in wood frame walls to be 75% for stud walls 16 in. on center and 78% for stud walls 24 in. on center. This effectively raises calculated values of wall <math>U_o</math>-values when standard RS-1 is used to do the <math>U_o</math>-value calculation.</p>

**Table 1.** (contd)

1993 MEC Section Number (Unless Identified as New)	Description of Change	Impact
801.1 (95)	The reference to RS-6 is deleted.	No impact because the 1995 MEC does not refer to the standard.
801.1 (95)	The RS-22 reference to <i>ASHRAE/IES Standard 90.1-1989</i> (ASHRAE 1989a) is replaced with a reference to the <i>Energy Code for Commercial and High-Rise Residential Buildings - Codification of ASHRAE/IES 90.1-1989</i> (ASHRAE 1993a).	Improves ability to implement energy-conservation requirements for commercial buildings.
801.1 (95)	RS-54 ( <i>NFRC 100-91</i> ) is added (NFRC 1991).	Makes compliance easier to determine, and assists with field verification during construction.
801.1 (95)	A new RS-55 for pool heaters is added.	Provides a test method for determining compliance.
802 (95)	The name and address of NFRC are added to the list of accredited authoritative agencies.	Makes compliance easier to determine, and assists with field verification during construction.

### 3.0 References

- American Society for Testing and Materials (ASTM). 1987. *E779-87*, "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization." (R-1992), North Brook, Illinois.
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE). 1980. *ANSI/ASHRAE/IES Standard 90A-1980*, "Energy Conservation in New Building Design." New York.
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## **Appendix**

### **Discrepancies Between Approved Code Changes and 1995 MEC**

## Appendix

### Discrepancies Between Approved Code Changes and 1995 MEC

This Appendix describes the discrepancies between code changes approved in the 1994 and 1995 code-change cycles and what actually appears in the 1995 MEC.

Section 301.2 is deleted in the 1994 amendments (Code Change No. E3-93) but appears in the 1995 MEC.

Section 402.1.1 gives the air-infiltration rate for the standard design as 0.51 air changes per hour but the approved code change (Code Change No. E38-94) gives 0.50 air changes per hour.

In Section 502.2.4, the text for slab-on-grade floors does not match with approved negative ballot for Code Change No. E72-94 and is not correct because, as written, it requires insulation extend for 48 in. for climates with less than 6000 heating degree-days, and this should be only 24 in. (the figure on page 38 in the appendix correctly gives 24 in.).

In Section 502.3.3, the text for  $U_g$ ,  $U_d$ , and  $U_s$  is missing additional descriptive language and the reference to Section 102.3 given in the approved negative ballot for Code Change No. E7-94.

Section 503.9.2 was deleted in the 1994 amendments; however, it is in the 1995 MEC.

Section 604.4.1 is not changed to delete the provisions for shower flow rates as in the approved negative ballot for Code Change No. E94-94. Section 604.4.1 is inconsistent with Section 504.8.1.