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## Differences Between the 1992 and 1993 CABO Model Energy Codes

D. R. Conover  
R. G. Lucas

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January 1995

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

Pacific Northwest Laboratory  
Operated for the U.S. Department of Energy  
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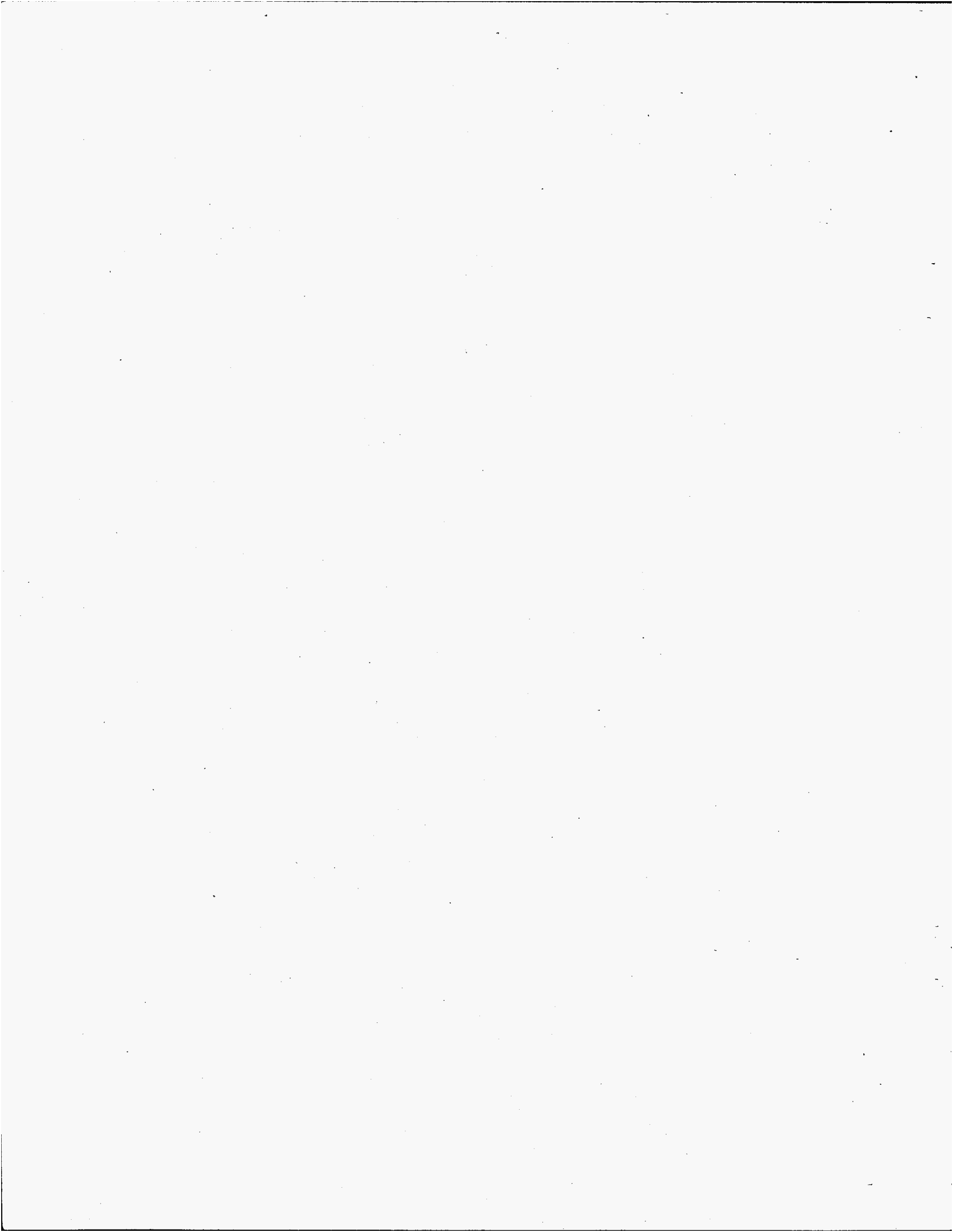
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## Foreword

This report is one in a series of documents describing research activities in support of the U.S. Department of Energy (DOE) Building Energy Standards 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 (EPAct, 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 1992 and 1993 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 (EPAct, Public Law 102-486) requires the U.S. Department of Energy (DOE) to determine if changes to the Council of American Building Officials (CABO) 1992 Model Energy Code (MEC) (CABO 1992), published in the 1993 edition of the MEC (CABO 1993), will improve energy efficiency in residential buildings. The DOE has determined that the provisions in the 1993 MEC improve energy efficiency in residential buildings<sup>(a)</sup> and has published a notice of this determination in the July 15, 1994 Federal Register (59 FR 36173-76). Each state is required to certify whether their state building code meets or exceeds the 1993 MEC within two years of this notice. Because states must compare their codes to both the 1992 MEC and the 1993 MEC, DOE expects considerable interest in the specific changes to the 1992 MEC as published in the 1993 MEC and their potential impact. Several states have already requested this information from DOE.

To help states and others identify and understand the impact of the changes to the 1992 MEC, DOE tasked the Pacific Northwest Laboratory (PNL) with identifying those changes and their impacts.

Most of the changes are minor. Some section numbers have changed in the 1993 MEC because provisions were added and deleted. Significant changes are listed below:

- The 1993 MEC has more stringent multifamily wall  $U_o$  value requirements at all heating degree-days (HDDs) and one- and two-family ceiling and wall requirements at low HDDs [Table 502.2.1].
- The 1993 MEC has new requirements for heating, ventilating, and air-conditioning (HVAC) equipment efficiencies, which are consistent with the National Appliance Energy Conservation Act of 1987 (Public Law 100-12) and updated voluntary consensus standards [Section 503].
- The 1993 MEC has new requirements for duct insulation [Section 503.9.1].
- In the 1993 MEC, requirements for multifamily residential buildings over three stories in height and all nonresidential buildings (i.e., commercial buildings, including hotels and motels) appear only in Chapter 7, which simply adopts by reference *ASHRAE/IES Standard 90.1-1989* (ASHRAE 1989). In the 1992 MEC, requirements for multifamily residential buildings over three stories in height and all nonresidential buildings were based on *ANSI/ASHRAE/IES Standard 90A-1980* (ASHRAE 1980) and were interspersed within the MEC. Note that this change does not affect requirements for residential buildings three stories or less in height (i.e., residential buildings).

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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.



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## 1.0 Introduction

The Energy Policy Act of 1992 (EPAct, Public Law 102-486) requires the U.S. Department of Energy (DOE) to determine if changes to the Council of American Building Officials (CABO) 1992 Model Energy Code (MEC) (CABO 1992), published in the 1993 edition of the MEC (CABO 1993), will improve energy efficiency in residential buildings. The DOE has determined that the provisions in the 1993 MEC improve energy efficiency in residential buildings<sup>(a)</sup> and has published a notice of this determination in the July 15, 1994 Federal Register (59 FR 36173-76). Each state is required to certify whether their state building code meets or exceeds the 1993 MEC within two years of this notice. Because states must compare their codes to both the 1992 MEC and 1993 MEC, DOE expects considerable interest in the specific changes to the 1992 MEC as published in the 1993 MEC and their potential impact. Several states have already requested this information from DOE.

To help states and others identify and understand the impact of the changes to the 1992 MEC, the DOE tasked the Pacific Northwest Laboratory (PNL) with identifying those changes and their impacts.

Section 2.0 of this report describes each change to the 1992 MEC, published in the 1993 MEC, and its impact. Referenced publications are listed in Section 3.0.

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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 1992 MEC Contained in 1993 MEC

Table 2.1 describes the changes made to the 1992 MEC that are published in the 1993 MEC. Most of these changes are minor. Some section numbers have changed in the 1993 MEC because provisions were added or deleted. These numbering changes are not addressed in Table 2.1. To fully understand all changes, a copy of both the 1992 MEC and 1993 MEC is required. All changes are identified within the 1993 MEC by vertical lines and asterisks (see page iii of the 1993 MEC for further details).

Significant changes are listed below:

- The 1993 MEC has more stringent multifamily wall  $U_o$  value requirements at all heating degree-days (HDDs) and one- and two-family ceiling and wall requirements at low HDDs [Table 502.2.1].
- The 1993 MEC has new requirements for heating, ventilating, and air-conditioning (HVAC) equipment efficiencies, which are consistent with the National Appliance Energy Conservation Act of 1987 (Public Law 100-12) and updated voluntary consensus standards [Section 503].
- The 1993 MEC has new requirements for duct insulation [Section 503.9.1].
- In the 1993 MEC, requirements for multifamily residential buildings over three stories in height and all hotels, motels, and nonresidential buildings (i.e., commercial buildings) appear only in Chapter 7, which simply adopts by reference *ASHRAE/IES Standard 90.1-1989* (ASHRAE 1989). In the 1992 MEC, requirements for multifamily residential buildings over three stories in height and all nonresidential buildings were based on *ANSI/ASHRAE/IES Standard 90A-1980* (ASHRAE 1980) and were interspersed within the MEC. Note that this change does not affect requirements for residential buildings three stories or less in height (i.e., residential buildings).

**Table 2.1. Changes to 1992 MEC Contained in 1993 MEC**

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
101.2	A reference to the new Chapter 7 on buildings other than residential buildings (i.e., commercial buildings <sup>(a)</sup> ) is added and Chapters 4, 5, and 6 are redirected to apply to only residential buildings. <sup>(b)</sup>	In conjunction with other revisions, eliminates provisions for buildings, except for residential buildings, that were based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> (ASHRAE 1980) and certain equipment efficiency provisions of <i>ASHRAE/IES Standard 90.1-1989</i> (ASHRAE 1989) from the body of the MEC. Solely references <i>ASHRAE/IES Standard 90.1-1989</i> for these buildings.
101.3	The new Chapter 7 is referenced.	See Section 101.2.
101.3.1.1 101.3.1.2	The description of buildings is added to cover residential and other buildings.	Shows buildings to which Chapters 4, 5, and 6 apply (residential buildings), and buildings governed by Chapter 7 (commercial buildings).
201.1	The definition of <b>Annual fuel utilization efficiency (AFUE)</b> is added.	Facilitates use of the term as applied in the MEC as a descriptor of the efficiency rating for fossil fuel-fired heating equipment.
201.1	The definitions of <b>Coefficient of performance (COP) - cooling</b> and <b>Coefficient of performance (COP) - heat pump - heating</b> are relocated to this section.	Has no impact. These definitions were in Chapter 5 of the 1992 MEC.
201.1	The definition of <b>Efficiency, HVAC system</b> is revised to specify output to be used and that input and output be in consistent units.	Clarifies how to determine HVAC system efficiency.
201.1	A reference to COP is added to the definition for <b>Energy efficiency ratio (EER)</b> .	Clarifies that an EER becomes a COP when consistent units are used.

- (a) Commercial buildings include hotels, motels, high-rise multifamily buildings and all other non-residential buildings (see footnote b) for the purpose of this report.
- (b) 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.

Table 2.1. (contd)

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
201.1	The definitions of <b>Furnace, duct and Furnace, warm air</b> are added.	Assists in distinguishing between different furnace types to apply efficiency requirements in the MEC.
201.1	A description of what constitutes <b>Group R residential buildings</b> is relocated to this section from the body of the 1992 MEC.	Has no impact.
201.1	A change in the state of a material is added as a source of energy in the definition of <b>Heat</b> .	Expands definition of heat.
201.1	The definition of <b>Heating seasonal performance factor (HSPF)</b> is added.	Facilitates the use of a term used in the MEC to specify heat pump equipment efficiency.
201.1	In the definition of <b>HVAC system</b> , the term "system" is replaced by the term "equipment, distribution network, and terminals."	Clarifies what HVAC system provisions apply to.
201.1	The definition of <b>Integrated part-load value (IPLV)</b> is added.	Facilitates the use of a term used in the MEC to specify HVAC equipment efficiency.
201.1	The definition of <b>Overall thermal transfer value (OTTV)</b> is deleted.	Has no impact because deleting provisions for commercial buildings and referencing <i>ASHRAE/IES Standard 90.1-1989</i> eliminates the need for the term.
201.1	The definition of <b>Packaged terminal air conditioner (PTAC)</b> is revised to include heating capability and the wall sleeve as part of the unit.	Clarifies the application of PTAC efficiency in the MEC.
201.1	The definition of <b>Packaged terminal heat pump (PTHP)</b> is revised to indicate a PTHP can provide heat.	Clarifies the application of PTHP efficiency criteria in the MEC.
201.1	The definition <b>Nondepletable energy sources</b> in the 1992 MEC is renamed <b>Renewable energy sources</b> .	Has no impact.
201.1	The definition of <b>Residential buildings</b> is added.	Defines residential buildings for the MEC.

Table 2.1. (contd)

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
201.1	The definition of <b>Seasonal energy efficiency ratio (SEER)</b> is added.	Facilitates the use of a term used in the MEC to specify HVAC equipment efficiency in the cooling mode.
201.1	The definition of <b>Shading coefficient (SC)</b> is deleted.	Has no impact because deleting provisions for commercial buildings and referencing <i>ASHRAE/IES Standard 90.1-1989</i> eliminates the need for the term.
201.1	The definition of <b>Slab-on-grade floor insulation</b> is added.	Has no impact.
201.1	The definitions of <b>Water Heater, Non-Storage</b> and <b>Water Heater, Storage</b> are added.	Facilitate application of the water heater efficiency requirements, which differ by water heater type.
301.1	The scope of Chapter 3 is changed to apply only to Group R residential buildings.	See Section 101.2.
302.1	Degrees north latitude is deleted as an exterior design condition.	Has no impact because deleting provisions for commercial buildings and referencing <i>ASHRAE/IES Standard 90.1-1989</i> eliminates the need to designate this value.
401.1	The scope of Chapter 4 is changed to apply only to Group R residential buildings.	See Section 101.2.
402.2	A provision that energy use at the site shall be compared and that conversion of energy sources shall be based on 1 kWh = 3,413 Btu is added.	Reinforces that the energy comparison only considers energy used at the building and does not consider the efficiency of generation, transmission, and distribution of electric power and other fuels prior to their delivery to the site.
402.5	Commercial and industrial buildings are deleted from the exception.	Has no impact because the scope of Chapter 4 is now only residential buildings.
403	The term "nondepletable source analysis" is changed to "renewable energy source analysis."	Has no impact.

**Table 2.1. (contd)**

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
403.2	The term "commercial structures" is deleted from Exception 1. Exception 2, which applies to commercial, institutional, and industrial structures, is completely deleted.	Has no impact. See Section 402.5.
501.1	The scope of Chapter 5 is changed to apply only to Group R residential buildings.	See Section 101.2.
501.1	Provisions requiring a building to meet the more stringent of its heating or cooling requirements are deleted.	Has no impact because the code only provides one set of requirements for residential building exterior envelope design.
502.1.1	References to Table 502.3.1 are deleted.	Has no impact because the table has been deleted and comparable provisions are found in Chapter 7 for commercial buildings.
502.2	Provisions defining Group R residential buildings are deleted.	Has no impact. See Sections 101.3.1.1 and 201 where these same provisions were relocated as a definition.
502.3 (1992 edition)	All thermal envelope provisions are deleted for buildings other than Group R residential buildings.	See Section 101.2.
502.3.2	The allowable air infiltration rates for nonwood windows and doors are changed. Separate requirements by frame type (wood, aluminum, and PVC) are added. Also, references are added to industry window and door construction standards. Requirements for nonresidential doors are removed.	Requirements for nonwood windows are slightly less stringent in the 1993 MEC than the 1992 MEC. Requirements for sliding doors are more stringent. Changes in these allowable air infiltration rates have an unclear effect on total heating and cooling energy use.
502.3.3	Wall assemblies and sill-plates and foundations are added as examples of areas in the building envelope to be sealed. Refers to openings in the building envelope rather than listing the envelope components.	Has no impact. Consists of minor wording changes that do not change the general requirement to seal all joints in the building envelope.

Table 2.1. (contd)

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
Equations 3 and 4 (1992 Edition)	These equations are deleted.	Has no impact because all provisions for commercial buildings are covered by reference to <i>ASHRAE/IES Standard 90.1-1989</i> ; this eliminates the need for these equations.
503.1	Hospitals, laboratories, and facilities with open refrigerated display cases are deleted from the exception.	Has no impact because Chapter 5 now only applies to Group R residential buildings.
503.4.1.3	Provisions to address HVAC equipment for which efficiency requirements are not given in the MEC are added.	Has no impact except to clarify that equipment not included in the efficiency tables can still be used and is "unregulated."
503.4.2 and Tables 503.4.2a through 503.4.2d	Electric-powered heat pump component minimum efficiencies, test procedures, and efficiency descriptors based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> are replaced with those from <i>ASHRAE/IES Standard 90.1-1989</i> .	Provides consistency with current standards and improves energy efficiency.
503.4.2	Efficiency level is referenced (as specified in the table that provides efficiencies) instead of COP.	Has no impact except to refer to the appropriate heat pump efficiency descriptor.
503.4.2.2 (1992 Edition)	The description of "COP heating" is deleted.	Has no impact because the term was added to the definitions chapter.
503.4.3 and Tables 503.4.3a through 503.4.3c	Fossil fuel-fired heating equipment minimum efficiencies, test procedures, and efficiency descriptors based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> are replaced with those from <i>ASHRAE/IES Standard 90.1-1989</i> .	Provides consistency with current standards and improves energy efficiency.
503.4.5 and Tables 503.4.5a through 503.4.5f	Electric-powered HVAC equipment minimum efficiencies in the cooling mode, test procedures, and efficiency descriptors based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> are replaced with those from <i>ASHRAE/IES Standard 90.1-1989</i> .	Provides consistency with current standards and improves energy efficiency.

Table 2.1. (contd)

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
503.4.5.1	Exemption for areas having open refrigerated food displays, such as supermarkets, is deleted.	Has no impact because requirements only apply to commercial buildings.
503.4.5.2 (1992 Edition)	The description of COP cooling is deleted.	Has no impact because the term was added to the definitions chapter.
503.4.6	Minimum-efficiency levels for water chilling packages, electrically operated, in the cooling mode based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> are replaced with those from <i>ASHRAE/IES Standard 90.1-1989</i> .	Provides consistency with current standards and improves energy efficiency.
503.4.6.1 (1992 Edition)	The description of COP cooling is deleted.	Has no impact because the term was added to the definitions chapter.
503.4.7 (1992 Edition)	Minimum-efficiency provisions for heat-operated cooling equipment based on <i>ANSI/ASHRAE/IES Standard 90A-1980</i> are deleted.	Has no impact because the provided minimums were commensurate with the achievable minimums for single-stage equipment.
503.8.3.3 (1992 Edition)	The provisions for temperature control of separate zones that were applicable to spaces other than dwelling units are deleted and incorporated into Section 503.8.3.2 of the 1993 MEC where they apply to the non-dwelling portion of multifamily structures.	Has no impact.
503.9	The minimum insulation requirement, based on temperature differential inside/outside the duct, is replaced with a prescriptive table of minimum duct insulation R-values as a function of climate.	Results in more or less energy savings, depending on climate and duct location.
503.10	References related to duct construction are updated and a reference to a NAIMA standard for fibrous glass duct construction is added.	Results in the application of more current standards.

**Table 2.1. (contd)**

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
504.2.2	Allowable heat loss from unfired hot-water storage tanks is reduced and an exception for larger tanks insulated to a specified R-value is added.	Results in greater energy savings.
504.5.2	See Section 403.	Has no impact.
505.3.3.1	"Etc." in the list of building types and the exception for theatrical and audiovisual areas in the 1992 MEC are deleted.	Allows the exception to the electric lighting power requirements to apply to only a few specific building types.
601.1	The reference to nonresidential buildings is deleted.	Has no impact. See Section 101.2.
602.1	Provisions are added allowing the designer to consider more innovative design concepts beyond thermal mass.	Provides more opportunity for the building official to approve innovative designs.
602.2.1	More charts are added for specific glass U-values, from which an opaque wall and wall U <sub>o</sub> criterion can be determined for a particular design.	Provides greater flexibility of use and accuracy in using Chapter 6 by presenting more charts corresponding to more window U-values.
602.2.2 602.2.3 602.2.4 602.2.5 602.2.6	Reference to Table 502.3.1 is deleted, which is in the 1992 MEC and covers high-rise residential and all commercial buildings.	Has no impact. Also see Section 101.2.
602.3.2	See Section 502.3.3.	See Section 502.3.3.
603.2	The presentation of all HVAC equipment performance requirements is deleted and the user is referred back to Section 503.4 where the requirements are already presented.	Has no impact except to eliminate presenting the same requirements twice in the MEC.
604.1.2.3	See Section 403.	See Section 403.

Table 2.1. (contd)

1993 MEC Section Number (Unless Noted)	Description of Change	Impact
Chapter 7	A new Chapter is added applying to buildings other than Group R buildings (i.e., other than one- and two-family dwellings and multifamily buildings three stories or less in height). Chapter 7 adopts <i>ASHRAE/IES Standard 90.1-1989</i> by reference. The 1992 MEC contains the technical provisions of <i>ANSI/ASHRAE/IES Standard 90A-1980</i> , which are replaced in Chapter 7 by <i>ASHRAE/IES Standard 90.1-1989</i> provisions for these buildings. Also see Section 101.2.	See Section 101.2. The impact on energy use is that attributable to the differences between <i>ANSI/ASHRAE/IES Standard 90A-1980</i> and <i>ASHRAE/IES Standard 90.1-1989</i> .
Chapter 8	Various referenced standards are updated and other referenced standards are added.	The changes between different editions of referenced standards are not reviewed here.
Figure No. 1	The maximum wall $U_o$ for multi-family residential buildings three stories or less in height is reduced. The maximum wall $U_o$ for one- and two-family residential buildings is reduced in areas below 2500 HDD.	Results in reduced heat loss/gain and associated reduction in loads and energy use.
Figure No. 2	The maximum roof/ceiling $U_o$ is reduced in areas with HDD below 3800.	Results in reduced heat loss/gain and associated reduction in loads and energy use.

### 3.0 References

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