


**Q** The Albuquerque  
Energy Conservation  
Code



Mayor Martin J. Chávez

ALBUQUERQUEGREEN

**VOLUME II**  
ONE - AND TWO - FAMILY  
DETACHED DWELLINGS  
AND TOWNHOUSES

# PREFACE

The City of Albuquerque, the Mayor's Office and the City Council are pleased to have developed the first comprehensive Energy Conservation Code in the State of New Mexico. The **2009 Albuquerque Energy Conservation Code** reflects a concerted, combined effort between local government and those in the building, and building-related, industries to develop a code acceptable to all. An effective Energy Conservation Code is essential to reduce the amount of greenhouse gases generated by buildings. It is estimated that the building industry generates 39% of carbon dioxide (CO<sub>2</sub>) emissions and 48% of all greenhouse gas (GHG) emissions in the United States.

The **2009 Albuquerque Energy Conservation Code** is one element of the Mayor's effort to achieve the goals of the 2030 Challenge ensuring new buildings are carbon neutral by the year 2030. Green building standards reduce greenhouse gas emissions by advancing energy efficiency and renewable green energy. Green buildings are cost-effective, provide healthy places for people to live, learn and work while supporting municipal conservation and environmental goals.

The City will be developing incentives through its Green Building Program to encourage building designs that will exceed the level set by the **2009 Albuquerque Energy Conservation Code**. And, with guidance from the Green Ribbon Task Force, the **2009 Albuquerque Energy Conservation Code** will be amended, at regular intervals, to keep pace with new energy conservation technologies.

The Mayor and the City Council would like to thank the Green Ribbon Task Force which includes leaders from the design and building industries, as well as others, for working together to craft such a comprehensive energy code. The assistance provided by the Task Force was invaluable.

**HOW TO USE  
VOLUME II OF THE ALBUQUERQUE ENERGY  
CONSERVATION CODE**

- I. THE 2009 ALBUQUERQUE ENERGY CONSERVATION CODE VOLUME II ADOPTS AND AMENDS THE 2006 INTERNATIONAL ENERGY CONSERVATION CODE.**
  
- II. SECTION AND TABLE NUMBERS THAT ARE IDENTIFIED IN THE 2009 ALBUQUERQUE ENERGY CONSERVATION CODE AMEND THE CORRESPONDING SECTIONS AND TABLES IN THE 2006 INTERNATIONAL ENERGY CONSERVATION CODE.**
  
- III. THE AMENDED PROVISIONS OF THE 2009 ALBUQUERQUE ENERGY CONSERVATION CODE SUPERSEDE THE CORRESPONDING PROVISIONS OF THE 2006 INTERNATIONAL ENERGY CONSERVATION CODE.**
  
- IV. THE 2009 ALBUQUERQUE ENERGY CONSERVATION CODE MUST BE USED IN CONJUNCTION WITH THE 2006 INTERNATIONAL ENERGY CONSERVATION CODE.**
  
- V. THE NEW MEXICO ENERGY CONSERVATION CODE IS NOT ADOPTED BY THE CITY OF ALBUQUERQUE.**

# CHAPTER 1

## ADMINISTRATION

### SECTION 101

#### SCOPE AND GENERAL REQUIREMENTS

**101.1 Title.** This code shall be known as the Albuquerque Energy Conservation Code - Volume II and shall be cited as such. It is referred to herein as “this code”.

**101.2 Scope.** This code applies to one- and two-family detached dwellings and townhouses.

**101.3 Intent.** This code shall regulate the design and construction of buildings for the effective use of energy. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy and to reduce greenhouse gas emissions in Albuquerque. This code is not intended to abridge safety, health, or environmental requirements contained in other applicable codes or ordinances.

**101.4 Adopted Code, Referenced Standards, and Referenced Sections of the International Residential Code.**

**101.4.1 Code.** This code adopts, by reference, and amends the 2006 International Energy Conservation Code.

**101.4.2 Standards.** The standards listed in Chapter 6 of this code shall be considered part of the requirements of this code to the extent that they are referenced.

**101.4.3 International Residential Code.** Sections of the International Residential Code, included in Chapter 7 of this code, shall be considered part of the requirements of this code to the extent that they are referenced.

**101.4.4 Conflicting requirements.** Where the provisions of this code and the 2006 International Energy Conservation Code or the standards referenced herein conflict, the provisions of this code shall take precedence.

**101.5 Validity.** If any section, subsection, sentence, clause, or phrase of this code is, for any reason, held to be unconstitutional, illegal, or void, such decision shall not affect the validity of the remaining portions of this code. The City of Albuquerque hereby declares that it would have adopted and implemented this code, and each section, subsection, clause, or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional, illegal, or void.

## **101.6 Applicability.**

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

**101.6.2 Historic buildings.** Exempt from this code are buildings: (1) listed in the State or National Register of Historic Places; (2) designated as a historic property under local or state designation law or survey; (3) certified as a contributing resource within a national register listed, or locally designated, historic district; (4) that, in the written opinion of the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are eligible to be listed in the National or State Registers of Historic Places either individually or as a contributing building within a historic district.

**101.6.3 Additions, alterations, renovations, or repairs.** Additions, alterations, renovations, or repairs to an existing building, building system, or portion thereof, shall conform to the prescriptive or the performance-based provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building, or building system, to comply with this code. Additions, alterations, renovations, or repairs shall not create an unsafe or hazardous condition or overload existing building systems.

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

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing single-rafter roof, wall, or floor cavities exposed during construction provided that these cavities are filled with insulation having a minimum nominal value of R-3.5 per inch of thickness.
4. Construction where the existing roof, wall, or floor cavity is not exposed.

**101.6.4 Substantial alterations.** Substantial alterations of existing buildings shall comply with Section 101.7.3 of this code and with the following:

1. HVAC equipment shall comply with Section 403.2 of this code.
2. HVAC controls shall comply with Section 403.3 of this code.

3. Service water heating equipment shall comply with Sections 403.8.6 and 403.8.7 of this code.
4. Electrical lighting shall comply with Section 403.9 of this code.

**Exception:** Substantial alterations that comply with Section 404 or Section 405 of this code.

**101.6.5 Roof replacement.** Where the roof of an existing building is being replaced and the roof is a component of the thermal envelope of a building regulated by this code, and the R-value of the existing roof insulation is less than 30, insulation shall be added to achieve R-30.

**Exceptions:**

1. Roof replacements where either the roof sheathing or the roof insulation is not exposed.
2. Where the insulation is continuous and is applied entirely above the roof sheathing, R-20 shall be allowed.
3. Insulation may be tapered to drain to existing scuppers provided the average R-value of the roof insulation complies with this section and that the minimum added R-value is not less than 3.
4. Where the overall U-value of the entire roof assembly is 0.034 or less.

**101.6.6 Change in occupancy.** Buildings undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code.

**101.7 Compliance.**

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

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

1. Those with a peak design rate of energy usage less than 3.4 Btu/h x ft<sup>2</sup> or 1.0 watt/ft<sup>2</sup> of floor area for space conditioning purposes.

2. Those that do not use fossil fuels or electricity that is produced from fossil fuels.
3. Those that do not contain conditioned space.

## **SECTION 102 MATERIALS, SYSTEMS, AND EQUIPMENT**

*Section 102 of the 2006 International Energy Conservation Code is adopted as written.*

## **SECTION 103 ALTERNATE MATERIALS, METHOD OF CONSTRUCTION, DESIGN, OR INSULATING SYSTEMS**

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

**103.1.1 Above-code programs.** One- and two-family dwellings and townhouses designed to obtain LEED Silver or Build Green New Mexico Silver certification are deemed to meet the greenhouse gas reduction goals of the City of Albuquerque and to be in compliance with this code provided that such buildings also comply with the mandatory provisions of this code. Applications for a building permit under these programs shall include the following:

1. Proof that the project has been registered with the United States Green Building Council (USGBC) or with Build Green New Mexico (BGNM).
2. A completed LEED checklist that has been prepared by a LEED Accredited Professional or a completed BGNM checklist that has been prepared by an accredited Home Energy Rating System (HERS) professional.
3. Energy modeling prepared, or approved, by an accredited Home Energy Rating System (HERS) professional.

Buildings permitted under this program are subject to all applicable provisions of the Albuquerque Uniform Administrative Code and to the inspections listed in Section 105 of this code.

## **SECTION 104 CONSTRUCTION DOCUMENTS**

*Section 104 of the 2006 International Energy Conservation Code is adopted as written.*

## **SECTION 105 ENERGY CONSERVATION INSPECTIONS**

**105.1 General.** Unless otherwise noted, work that is regulated by this code shall be subject to the inspections and the tests listed in Table 105.1 and in Section 105.3 of this code.

**105.2 Inspections by code official.** Inspections listed in Table 105.1 of this code shall be made by the code official. No work shall be done on any part of the building beyond the point indicated in each successive inspection without first obtaining the written approval of the code official. No construction or systems shall be concealed without being inspected and approved. When determined necessary by the code official, all work shall be subject to re-inspection.

**105.3 Independent third-party inspections and tests.** The inspections and tests listed in Sections 105.3.1, 105.3.2, and 105.3.3 of this code shall be performed by, or under the direct supervision of, a RESNET Certified Home Energy Rater. No construction or systems shall be concealed without being inspected or tested and approved. When determined necessary by the Home Energy Rater, all work shall be subject to re-inspection or re-testing. Any construction or systems that are concealed before being re-inspected or re-tested and approved by the Home Energy Rater shall be immediately reported to the code official. Where multiple homes of the same model are to be built by the same builder, a representative sample of homes may be tested subject to the sampling protocol described in the latest edition of the RESNET Mortgage Industry National Home Energy Rating Standards.

**105.3.1 Thermal bypass inspections.** Unless otherwise noted, all work regulated by this code shall be visually inspected in accordance with the ENERGY STAR Thermal Bypass Checklist Guide. Inspections shall verify that all air barriers have been installed, that insulation is in proper alignment with the air barriers, and that thermal barriers are continuous and complete. Any item found to be non-compliant with the ENERGY STAR Thermal Bypass checklist shall be corrected.

### **Exceptions:**

1. Subject to the approval of the Home Energy Rater, up to four items on the ENERGY STAR Thermal Bypass Inspection Checklist may be self-verified by the builder.

2. Slab-edge and under-slab insulation shall be inspected by the code official in accordance with Section 105.2 of this code.

**105.3.1.1 Additions, alterations, renovations, or repairs.** For additions less than 500 square feet in area, alterations, renovations, or repairs, thermal bypass inspections shall be made by the code official and a completed ENERGY STAR Thermal Bypass Inspection Checklist shall not be required.

**105.3.1.2 Substantial alterations.** Thermal bypass inspections of substantial alterations, as defined in Chapter 2 of this code, shall comply with Sections 105.3, 105.3.1, and 105.3.1.3 of this code.

**105.3.1.3 Report requirement.** An ENERGY STAR Thermal Bypass Inspection Checklist shall be completed by the Home Energy Rater. The completed checklist shall indicate the address and the building permit number of the work inspected and the dates on which the work was inspected. The completed checklist shall be signed by the Home Energy Rater only after any items found to be non-compliant with the ENERGY STAR Thermal Bypass Checklist Guide have been corrected. The completed and signed checklist shall be posted at the jobsite and shall be made available to the code official at or before the final building inspection.

**105.3.2 Duct leakage test.** For each newly installed system, the air leakage rate from ducts to the outdoors shall not exceed 4.0 CFM at 25 Pascals per 100 square feet of conditioned floor area or 6% of the total air flow rate in the HVAC system. Tests shall be conducted using a duct pressurization fan.

**Exception:** A duct leakage test shall not be required if all ducts and air-handling equipment are located in conditioned space and the building envelope air leakage rate, tested in accordance with Section 105.3.3 of this code, does not exceed 3.0 ACH50 or 0.25 CFM /ft<sup>2</sup> of building enclosure area at 50 Pascals.

**105.3.2.1 Report requirement.** A duct leakage test report shall be completed by the Home Energy Rater. The report shall indicate the address and the building permit number of the project where the test was conducted and shall include the date that the test was conducted. The date of any re-tests shall also be indicated in the report. The test report shall be signed by the Home Energy Rater only after it has been determined that the air leakage rate from the duct system to the outdoors complies with Section 105.3.2 of this code. The completed and signed

test report shall be posted at the jobsite and shall be made available to the code official at or before the final building inspection.

**105.3.3 Building envelope leakage test.** The air leakage rate from the building envelope shall not exceed 6.0 ACH50 or 0.35 CFM/ft<sup>2</sup> of building enclosure area at 50 Pascals. A blower door de-pressurization test shall be performed to verify the air leakage rate from the building envelope.

**105.3.3.1 Additions, alterations, renovations, or repairs.** A building envelope leakage test shall not be required for additions less than 500 square feet in area, alterations, renovations, or repairs.

**105.3.3.2 Substantial alterations.** The air leakage rate from buildings undergoing substantial alterations, as defined in Chapter 2 of this code, shall be tested in accordance with, and shall comply with, Sections 105.3, 105.3.3, and 105.3.3.3 of this code.

**105.3.3.3 Report requirement.** A building envelope leakage test report shall be completed by the Home Energy Rater. The report shall indicate the address and the building permit number of the project where the test was conducted and shall include the date that the test was conducted. The date of any re-tests shall also be indicated in the report. The test report shall be signed by the Home Energy Rater only after it has been determined that the air leakage rate from the building envelope complies with Section 105.3.3 of this code. The completed and signed report shall be posted at the jobsite and shall be made available to the code official at or before the final inspection.

**TABLE 105.1  
ENERGY CONSERVATION INSPECTIONS**

	<b>COMPONENT</b>	<b>CODE REFERENCES</b>	<b>WHEN INSPECTED</b>
Thermal Envelope	1. Slab Insulation	Section 402.2 of the 2006 IECC and Table 402.1.1 of this code	Foundation Insulation Inspection
	2. Frame Insulation	Section 402.2 of the 2006 IECC and Table 402.1.1 of this code	Frame Insulation
	3. Roof Ventilation	Section R806 of the 2006 IRC <sup>a</sup> and Section 402.7 of this code	Building Final
	4. Roof Reflectance	Section 402.8 of this code	Building Final
Heating, Ventilating, and Air-Conditioning System	1. Duct Sealing and Support	Sections M1601.3.1 and M1601.3.2 of the 2006 IRC <sup>a</sup> and Section 403.4.2 of this code	Below Slab: Duct Groundwork Inspection Above Slab: Heating/Cooling Top-Out
	2. Duct Insulation	Section 403.4.1 of this code	Below Slab: Duct Groundwork Inspection Above Slab: Heating/Cooling Top-Out
	3. Pipe Insulation	Section 403.9.5 of this code	Below Slab: Plumbing Groundwork Inspection Above: Plumbing Top-out
	4. Controls	Section 403.3 of this code	Heating/Cooling Final
Service Water Heating System	1. Pipe Insulation	Section 403.8.5 of this code	Below Slab: Plumbing Groundwork Inspection Above Slab: Plumbing Top-out
	2. Controls	Section 403.8.4 of this code	Plumbing Final
	3. Conservation of Hot Water	Section 403.8.6 of this code	Plumbing Final
	4. Heat Trap	Section 403.8.7 of this code	Plumbing Top-out
Heated Swimming Pools	1. Pipe Insulation	Section 403.8.5 of this code	Pool/solar Heating Rough-In
	2. Energy Source	Section 403.8.2.1 of this code	Pool/Solar Heating Rough-In
	3. Insulating Cover	Section 403.8.2.3 of this code	Pool Final
	4. Controls	Section 403.8.2.2 and 403.8.2.4 of this code	Pool Final
Electrical Lighting	1. Lighting Efficiency	Section 403.9 of this code	Recessed Fixtures: Electrical; Rough-In Surface – Mounted Fixtures and Luminaries: Electrical Final

IECC = International Energy Conservation Code  
IRC = International Residential Code

a. IRC references are reprinted in Chapter 7 of this code

## CHAPTER 2

# DEFINITIONS

*Chapter 2 of the 2006 International Energy Conservation Code is adopted as written with the following additions:*

**AIR-IMPERMEABLE INSULATION.** An insulation with an air permeability equal to or less than  $0.02 \text{ L/m}^2$  at 75 Pa pressure differential tested according to ASTM B 2178 or B 283.

**ENERGY STAR.** A joint program of the United States Environmental Protection Agency and the United States Department of Energy to identify and label energy-efficient products that will reduce greenhouse gas emissions.

**HIGH-USE ROOMS.** Kitchens, dining rooms, living rooms, family rooms, dens, and similar rooms or spaces.

**MEDIUM-USE ROOMS.** Bedrooms, home offices, hallways, and similar rooms or spaces.

**SUBSTANTIAL ALTERATION.** Any alteration where the work area exceeds 50 percent of the aggregate area of the building.

**TOWNHOUSE.** A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof, has open space on at least two sides, is not more than three stories in height, and does not share means of egress with any other units.

**WORK AREA.** That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

## CHAPTER 3

# CLIMATE ZONES

### SECTION 301

#### CLIMATE ZONES

**301.1 Climate zone.** Albuquerque is in Climate Zone 4 and it is in a Dry (B) location.

**301.2 Warm humid counties.** Albuquerque is not in a warm humid county.

*The balance of Chapter 3 of the 2006 International Energy Conservation Code is deleted in its entirety.*

# CHAPTER 4 ENERGY EFFICIENCY

## SECTION 401 GENERAL

**401.1 Compliance.** Projects shall comply with the Mandatory provisions of this code and either:

1. The Prescriptive provisions of this code; or
2. Section 404 (performance).

**401.2 Certificate.** A permanent certificate shall be posted in a conspicuous place within the dwelling or attached garage. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall, and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of heating, cooling, and service water heating equipment.

## SECTION 402 BUILDING THERMAL ENVELOPE

*Section 402 of the 2006 International Energy Conservation Code is adopted as written with the following modifications, additions, and deletion:*

**Table 402.1.1.** *Table 402.1.1 of the 2006 International Energy Conservation Code is replaced by Table 402.1.1 of this code.*

**Table 402.1.3.** *Table 402.1.3 of the 2006 International Energy Conservation Code is replaced by Table 402.1.3 of this code.*

**402.2.2 Ceilings without attic spaces.** *Section 402.2.2 of the 2006 International Energy Conservation Code is deleted in its entirety.*

**402.7 Roof Ventilation. (Mandatory).** Roofs shall be ventilated in accordance with Chapter 7 of this code.

**402.8 Roof Reflectance. (Prescriptive).** Roof coverings that meet one of the following standards shall be installed on new roofs and on existing roofs that are being re-roofed:

1. Reflective roof coverings that are Energy Star qualified.
2. Low slope (2 inches in 12, or less) roof coverings that have an initial solar reflectance of 0.65 or greater as determined by the Cool Roof Rating Council.
3. Steep slope (greater than 2 inches in 12) roof coverings that have an initial solar reflectance of 0.25 or greater as determined by the Cool Roof Rating Council.

**Exception:** Vegetated “green roofs” when approved by the Green Building Program Manager.

**TABLE 402.1.1  
BUILDING THERMAL ENVELOPE<sup>a</sup>**

Fenestration U-Factor <sup>b</sup>	Skylight U-Factor	Skylight SHGC	North-, East- West-Facing Glazed Fenestration	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement <sup>c</sup> Wall R-Value	Slab R-Value & Depth	Crawl Space <sup>c</sup> Wall R-Value
0.35	0.60 (NFRC2001) 0.45 (RES97)	0.40	Low-E Glass Required	38	21 or 13+7.5 <sup>e</sup>	5	21	10/13	R~10/2ft <sup>d</sup>	10/13

- a. R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 x 6 cavity.
- b. The fenestration U-factor column excludes skylights.
- c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- d. In addition, continuous insulation with a minimum R-value of 5 shall be installed under heated slabs.
- e. "13+7.5" means R-13 cavity insulation plus R-7.5 insulated sheathing.

NR = No Requirement  
SHGC = Solar Heat Gain Coefficient

**TABLE 402.1.3  
EQUIVALENT U-FACTORS<sup>a</sup>**

Fenestration U-Factor <sup>b</sup>	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawl Space Wall R-Factor
0.35	0.60 (NFRC2001) 0.45 (RES97)	0.030	0.051	0.141	0.046	0.059	0.065

- a. Nonfenestration U-factors shall be obtained from measurement, calculation.

**SECTION 403  
BUILDING SYSTEMS AND EQUIPMENT  
(Mandatory)**

**403.1 General.** This section covers mechanical, plumbing, and electrical systems and equipment used to provide heating, ventilating, air-conditioning and lighting functions.

**403.2 Fans.** Fans shall meet the specified minimum performance shown in Table 403.2.

**TABLE 403.2  
FAN PERFORMANCE**

Equipment Category	Subcategory	Energy Star Label Required	Minimum Performance
Ventilating fans	Range hood (up to 500 cfm)	Yes	2.8 cfm/watt
	Bathroom and utility fans (10-80 cfm)	Yes	1.4cfm/watt <sup>b</sup>
	Bathroom and utility fans (90-130 cfm)	Yes	2.8 cfm/watt <sup>c</sup>
	Bathroom and utility fans (140-500 cfm)	Yes	2.8 cfm/watt <sup>c</sup>
	In-line fans (single-port and multi-port)	Yes	2.8 cfm/watt
Ceiling Fans	n/a	Yes	155 cfm/watt at low speed and 75 cfm/watt at high speed

- a. Light sources must use pin-based fluorescent technology.
- b. Minimum rated airflow at 0.25 static w.g. 60% of 0.1.
- c. Minimum rated airflow at 0.25 static w.g. 70% of 0.1 static w.g. airflow

**403.3 Controls.**

**403.3.1 Programmable thermostats.** At least one programmable thermostat shall be provided for each separate heating and cooling system.

**403.3.2 Bathroom and laundry room fans.** Ventilating fans installed in bathrooms or laundry rooms shall be controlled by an occupancy sensor or an automatic-timer switch.

**403.3.3 Heat pump supplementary heat.** Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

**403.4 Ducts.**

**403.4.1 Insulation.** Supply and return ducts shall be insulated to a minimum of R-8. Ducts in floor trusses shall be insulated to a minimum of R-6.

**Exception:** Ducts, or portions thereof, located completely inside the building thermal envelope.

**403.4.2 Sealing and support.** All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.1 of the *2006 International Residential Code*. Ducts shall be supported in accordance with Section M1601.3.2 of the *2006 International Residential Code*.

**403.4.3 Building cavities.** Building framing cavities shall not be used as supply ducts.

**Exception:** Under-floor plenums constructed in accordance with nationally-recognized standards.

**403.5 Mechanical system piping insulation.** Mechanical system piping capable of carrying fluids above 105° F (41° C) or below 55° F (13° C) shall be insulated to a minimum of R-4 for piping two inches, or less, in diameter and to a minimum of R-6 for piping greater than two inches in diameter.

**403.6 Mechanical ventilation.** Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

**403.7 System sizing.** Heating and cooling systems shall be sized in accordance with 403.8.1 through 403.8.3.

**403.7.1 Equipment sizing.** Heating and cooling equipment shall be sized based on building loads calculated in accordance with the most current version of ACCA Manual J.

**403.7.2 Duct sizing.** Ducts shall be sized in accordance with the most current version of ACCA Manual D.

**403.7.3 Equipment selection.** Heating and cooling equipment selection shall be in accordance with the most current version of ACCA Manual S.

**Exception:** Other heating and cooling system sizing methodologies approved by the Green Building Program Manager.

**403.7.4 Documentation of system sizing.** Documentation verifying the accuracy of heating and cooling equipment and duct sizing shall be submitted with each application for a building permit and shall include the following information:

1. The address of the proposed work and an indication of the model type if the plan will be reissued.
2. Heating and cooling load calculations.
3. The indoor and outdoor temperatures used to perform the heating load calculations.

4. The indoor and outdoor temperatures used to perform the cooling load calculations.
5. Equipment and duct sizing calculations.
6. The name of the person that performed the calculations.
7. The name and version of software used to perform the calculations.

## **403.8 Service water heating.**

**403.8.1 Scope.** The purpose of this section is to provide criteria for design and equipment selection that will produce energy savings when applied to service water heating. Water supplies to ice-making machines and refrigerators shall be taken from a cold-water line of the water distribution system.

**403.8.2 Swimming pools.** Swimming pools shall be provided with energy-conserving measures in accordance with Sections 403.8.2.1 through 403.8.2.4 of this code.

**403.8.2.1 Energy source.** The primary source of energy for heating swimming pools shall come from solar collectors.

**403.8.2.2 On-off switch.** All pool heaters shall be equipped with an ON-OFF switch mounted for easy access to allow shutting off the operation of the heater without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

**403.8.2.3 Pool covers.** Pools heated to more than 90 degrees Fahrenheit shall be equipped with a pool cover that has a minimum insulation value of R-12.

**Exception:** Pools deriving more than 50 percent of the energy for heating from solar collectors are exempt from this requirement.

**403.8.2.4 Time clocks.** Time clocks shall be installed so that the pump can be set to run in the off-peak electric demand period and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

**403.8.3 Spas and hot tubs.** The walls and undersides of spas and hot tubs heated to more than 90 degrees Fahrenheit shall be insulated on the exterior side with approved insulation having a minimum insulation value of R-12.

**403.8.4 Hot water system controls.** Automatic-circulating hot water system pumps or heat trace shall be arranged to be conveniently turned off, automatically or manually, when the hot water system is not in operation.

**403.8.5 Pipe insulation.** In circulating systems, all circulating service hot water piping shall be insulated to a minimum R-4 for piping two inches, or less, in diameter and to a minimum of R-6 for piping greater than two inches in diameter. In non-circulating systems, the first 8 feet of outlet piping and the piping between the tank inlet and the inlet heat trap shall be insulated to a minimum of R-4 for piping two inches, or less, in diameter and to a minimum of R-6 for piping greater than two inches in diameter.

**403.8.6 Conservation of hot water.** Hot water shall be conserved in accordance with Sections 403.9.5.1 and 403.9.5.2 of this code.

**403.8.6.1 Showers.** Shower heads shall have a maximum flow rate of 2.5 gallons per minute (gpm) at a pressure of 80 pounds per square inch (psi).

**403.8.6.2 Faucets.** Sink and lavatory faucets shall have a maximum flow rate of 2.2 gallons per minute (gpm) at a pressure of 60 pounds per square inch (psi).

**403.8.7 Heat traps.** Water heaters with vertical pipe risers shall have a heat trap on both the inlet and outlet of the water heater unless the water heater has an integral heat trap or is part of a circulating system.

**403.9 Lighting Fixtures.** Hard-wired lighting fixtures shall comply with Sections 403.9.1 through 403.9.4.

**403.9.1 High-use rooms.** 50% of the fixtures in high-use rooms shall be *ENERGY STAR* labeled fixtures.

**403.9.2 Medium-use rooms.** 25% of the fixtures in medium-use rooms shall be *ENERGY STAR* labeled fixtures.

**403.9.3 Closets, pantries, utility rooms, laundry rooms, sheds, garages, and unfinished basements.** 100% of the fixtures installed in closets, pantries, utility rooms, laundry rooms, sheds, garages, and unfinished basements shall be *ENERGY STAR* labeled fixtures.

**403.9.4 Outdoor lighting.** 50% of outdoor fixtures, excluding landscape lighting, shall be *ENERGY STAR* labeled fixtures.

**SECTION 404**  
**SIMULATED PERFORMANCE ALTERNATIVE**  
**(Performance)**

*Section 404 of the 2006 International Energy Conservation Code is adopted as written with the following modifications:*

**404.2 Mandatory requirements.** Compliance with this Section requires that all of the Mandatory provisions of this code be met.

**Table 404.5.2(1).** *Table 404.5.2(1) of the 2006 International Energy Conservation Code is replaced by Table 404.5.2 (1) of this code.*

**TABLE 404.5.2(1)  
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

<b>Building Component</b>	<b>Standard Reference Design</b>	<b>Proposed Design</b>
Above-grade walls	Type: Mass wall if proposed wall is mass: otherwise wood frame Gross area: same as proposed U-Factor: from Table 402.1.3 Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement & crawl space walls	Type: same as proposed Gross area: same as proposed U-Factor: from Table 402.1.3 w/insulation layer on interior side of walls	As proposed As proposed As proposed
Above-grade floors	Type: wood frame Gross area: same as proposed U-Factor from Table 402.1.3	As proposed As proposed As proposed
Ceilings	Type: wood frame Gross area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed
Roofs	Gross area: same as proposed Reflectivity: from Section 402.8	As proposed As proposed
Attics	Type: vented with aperture = 1 ft <sup>2</sup> per 300 ft <sup>2</sup> ceiling area	As proposed
Foundations	Type: same as proposed	As proposed
Doors	Area: 40 ft <sup>2</sup> Orientation: North U-factor: Same as fenestration from Table 402.1.3	As proposed As proposed As proposed
Glazing <sup>a</sup>	Total area <sup>b</sup> = (a) The proposed glazing area; where the proposed glazing area is less than 15% of the conditioned floor area (b) 15% of the conditioned floor area; where the proposed glazing area is 15% or more of the conditioned floor area Orientation: equally distributed to four cardinal compass Orientations (N,E,S & W) U-factor: from Table 402.1.1 SHGC: from Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used interior shade fraction Summer: (all hours when cooling is required) = 0.70 Winter: (all hours when heating is required) = 0.85 External shading; none	As proposed     As proposed As proposed As proposed Same as standard reference design <sup>c</sup>
Skylights	U-factor: from table 402.1.1	As proposed
Thermally isolated sunrooms	None	As proposed

Building Component	Standard Reference Design	Proposed Design
Air-exchange rate	Specific Leakage Area (SLA) $\rho=0.00036$ assuming no energy recovery	For residences that are not tested, the same as the standard reference design For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate <sup>e</sup> but not less than 0.35 ACH For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate <sup>e</sup> combined with the mechanical ventilation rate, <sup>f</sup> which shall not be less than $0.01 \times \text{CFA} + 7.5 \times (N_{br} + 1)$ where: CFA = conditioned floor area $N_{br}$ number at bedrooms
Mechanical ventilation	Electric ventilation fans efficiencies: In accordance with table 403.2 of this code	As proposed
Internal gains	$IGain=17,900 + 23.8 \times \text{CFA} + 4104 \times N_{br}$ (Btu/day per dwelling unit)	Same as standard reference design
Internal mass	An Internal mass for furniture and contents of 8 pounds per square foot of floor area	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element <sup>g</sup> but not integral to the building envelope or structure
Structural mass	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air For masonry basement walls, as proposed, but with insulation required by Table 402.1.3 located on the interior side of the walls For other walls, for ceilings, floors and interior walls, wood frame construction	As proposed As proposed
Heating systems <sup>h, i</sup>	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency Capacity: sized in accordance with Section M1401.3 of the <i>International Residential Code</i>	As proposed As proposed As proposed As proposed
Cooling systems <sup>h, j</sup>	Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards Capacity: sized in accordance with Section M1401.3 of the <i>International Residential Code</i>	As proposed As proposed As proposed
Service Water Heating <sup>h, k</sup>	Fuel type: same as proposed design Efficiency: in accordance with prevailing federal minimum standards Use: $gal/day = 30 + 10 \times N^{br}$ Tank temperature: 120°F	As proposed As proposed Same as standard reference Same as standard reference
Thermal distribution systems	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies	Same as standard reference design, except as specified by Table 404.5.2(2)
Thermostat	Type: programmable, cooling temperature set point =78°F; Heating temperature set point = 68°F	Same as standard reference design

For SI: square foot = 0.93m<sup>2</sup>; 1 British thermal unit = 1055 J; 1 pound per square foot = 4.88kg/m<sup>2</sup>; 1 gallon (US) = 3.785L; °C = (°F-32)/1.8.

- a. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, what enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding

conditioned basements. For doors where the sunlight-transmitting opening is less than 50% of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.

- b. For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine glazing area:  
AF =  $A_s \times FA \times F$  where:  
AF = Total glazing area.  
As = Standard reference design total glazing area.  
FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 x below-grade boundary wall area).  
F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.  
and where:  
Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions. Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil. Below-grade boundary wall is any thermal wall in soil contact.  
Common wall area is the area of walls shared with an adjoining dwelling unit.
- c. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.
- d. Where Leakage Area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:  
SLA = L/CFA  
where L and CFA are in the same units.
- e. Tested envelope leakage shall be determined and documented by an independent party approved by the code official. Hourly calculations as specified in the 2001 ASHRAE Handbook of Fundamentals, Chapter 26, page 26.21, Equation 40 (Sherman-Gimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.
- f. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE Handbook of Fundamentals, Chapter 26.24 and the "Whole-house Ventilation" provision of 2001 ASHRAE Handbook of Fundamentals, page 26.19 for intermittent mechanical ventilation.
- g. Thermal Storage element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connect to such a room with pipes or ducts that allow the element to be actively charged.
- h. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
- i. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for the standard reference design and proposed design. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.
- j. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
- k. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum Energy Factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

## SECTION 405 WHOLE BUILDING PERFORMANCE RATING METHOD (Performance)

**405.1 Scope.** This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, service water heating, and hard-wired electrical lighting and fan energy only.

**405.2 Mandatory requirements.** Compliance with this Section requires that all of the Mandatory provisions of this code be met.

**405.3 Performance-based compliance.** Compliance with this Section requires that a proposed residence consume 30% less energy than a standard design complying with the minimum requirements of the 2006 International Energy Conservation Code.

**405.4 Documentation requirements.** Simulated energy performance shall be submitted with each permit application. The information submitted shall include the following:

1. Address of the proposed residence;
2. Model number of the proposed residence (if applicable);
3. Calculated values for the baseline residence performance, the proposed residence performance, and the percentage of improvement;
4. A list of energy-related features that are included in the design and on which the performance rating is based. This list shall document all of the energy-related features that differ between the proposed residence model and the baseline residence model;
5. Name of individual completing the simulated energy performance documentation; and
6. Name and version of the simulation program.

**405.5 Calculation procedure.** The proposed residence design and the baseline residence design shall be calculated using the following:

1. The same simulation program;
2. The same geographical location;
3. The same weather data; and
4. The same orientation of the building on the site unless otherwise approved by the building official.

**405.6 Simulation program.**

**405.6.1 Minimum capabilities.** Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the baseline residence design and the proposed residence design and shall include the following capabilities:

1. Computer generation of the baseline residence design using only the input for the proposed residence design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the baseline residence design;
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the baseline residence design in accordance with Section 403.8.1 of this code; and
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating, and air conditioning equipment based on climate and equipment sizing.

## **CHAPTER 5 COMMERCIAL ENERGY EFFICIENCY**

*Chapter 5 of the International Energy Conservation Code is deleted in its entirety. It is replaced by the 2009 Albuquerque Energy Conservation Code- Volume I, Commercial and Multi-Family Residential Buildings.*

## **CHAPTER 6 REFERENCED STANDARDS**

*Chapter 6 of the 2006 International Energy Conservation Code is adopted as written.*

## **CHAPTER 7 REFERENCED SECTIONS OF THE INTERNATIONAL RESIDENTIAL CODE (IRC)**

## **ROOF VENTILATION (IRC SECTION R806)**

**R806.1 Ventilation required.** Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with 1/8 inch minimum to ¼ inch maximum openings.

**R806.2 Minimum area.** The total net free ventilating area shall not be less than 1/150 of the area of the space ventilated except that reduction of the total area to 1/300 is permitted, provided that at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet above the eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1/300 when a vapor barrier having a transmission rate not exceeding 1 perm is installed on the warm-in-winter side of the ceiling.

**R806.3 Vent and insulation clearance.** Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch space shall be provided between the insulation and the roof sheathing and at the location of the vent.

**R806.4 Unvented attic assemblies.** Unvented attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) shall be permitted if all of the following conditions are met:

1. The unvented attic space is completely contained within the building thermal envelope.
2. No interior vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly.
3. Where wood shingles or shakes are used, a minimum ¼ inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In climate zones 5, 6, 7, and 8, any air-impermeable insulation shall be a vapor retarder, or shall have a vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Either items a, b, or c shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
  - a. Air-impermeable insulation only. Insulation shall be applied in direct contact to the underside of the structural roof sheathing.

- b. Air-permeable insulation only. In addition to the air-permeable insulation installed directly below the structural roof sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.4 for condensation control.
- c. Air-impermeable and air-permeable insulation. The air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.4 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

**INSULATION FOR CONDENSATION CONTROL  
(IRC TABLE R806.4)**

<b>CLIMATE ZONE</b>	<b>MINIMUM RIGID BOARD OR AIR-IMPERMEABLE INSULATION R-VALUE<sup>a</sup></b>
<b>2B and 3B tile roof only</b>	<b>0 (none required)</b>
<b>1, 2A, 2B, 3A, 3B, 3C</b>	<b>R-5</b>
<b>4C</b>	<b>R-10</b>
<b>4A,4B</b>	<b>R-15</b>
<b>5</b>	<b>R-20</b>
<b>6</b>	<b>R-25</b>
<b>7</b>	<b>R-30</b>
<b>8</b>	<b>R-35</b>

a. Contributes to, but does not supersede, Table 402.1.1 of this code.

**JOINTS AND SEAMS  
(IRC SECTION M1601.3.1)**

**M1601.3.1 Joints and seams.** Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gaskets, or other approved closure systems. Closure systems used with rigid fibrous glass ducts shall comply with UL 18 1A and shall be marked “18 1A-P” for pressure-sensitive tape, “181A-M” for mastic, or “181A-H” for heat-sensitive tape. Closure systems used with flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181B-FX” for pressure-sensitive tape or “181B-M” for mastic. Duct connections to flanges of air distribution system equipment or sheet metal fittings shall be mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked 18 1B-C. Crimp joints for round metal ducts shall have a contact lap of at least 1 1/2 inches and shall be mechanically fastened by means of at least three sheet-metal screws or rivets equally spaced around the joint.

**SUPPORT**  
**(IRC SECTION M1601.3.2)**

**M1601.3.2 Support.** Metal ducts shall be supported by ¼-inch wide 18-gage metal straps or 12-gage galvanized wire at intervals not exceeding 10 feet or other approved means. Nonmetallic ducts shall be supported in accordance with the manufacturer's installation instructions.