Michigan Energy Code Training and Implementation Program

4.0 Hour Residential Program Course Number 16109
2009 Michigan Uniform Energy Code

School of Planning, Design & Construction

Michigan State University
East Lansing, Michigan
Presenters

Michigan Residential Energy Code Training and Implementation Program:

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Course Number: 16109

4 Hours Technical:
*BI, MI, or registrants with only BO/PR but no inspector registration*
Project Support

Prepared by the School of Planning, Design and Construction at Michigan State University. Oversight provided by MSU faculty and the Center for Construction Project Performance Assessment and Improvement (C2P2ai).

Project Objectives

To train building officials, inspectors, home builders, subcontractors, suppliers, engineers and architects in the revised Michigan energy code for the purpose of:

1. Increasing understanding
2. Improving compliance
3. Reducing administrative time
4. Improving customer relationships
Presentation Overview

- Need For Energy Codes
- Michigan Code Status
- 2009 IECC and MUEC¹
- Compliance Tools¹
- REScheck Software²
- Additional Resources

¹As adapted from U.S. DOE provided instructional resources on the 2009 IECC with MI amendments

²Based on U.S. DOE REScheck training case study applied to Michigan climate zone 5
The Need For Energy Codes

U.S. Energy Use

Industry 27%
Buildings 39%
Transportation 34%

What Do Building Energy Codes and Standards Cover?

For both residential and commercial:

- Building Envelope
- Mechanical
- Service Water Heating
- Lighting
- Electrical Power

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Go To: www.energycodes.gov

Date visited: 3/14/2011
Michigan Code Status

Status of State Energy Codes

**Michigan**

*as of 2011-03-09*

Do you know of updates to the information on this page? If so, please [let us know](http://www.energycodes.gov/status/submit.php).

**CURRENT NEWS**

The energy code in Michigan has been finalized. The new code will be the 2009 International Energy Conservation Code for residential dwellings and ASHRAE 90.1-2007 for commercial buildings. The code will go into effect in March 2011.

**RESIDENTIAL**

- **Residential Code**: 2009 IECC
- **MI Amendments**
- **Approved Compliance Tools**: Can use REScheck
- **Approximate Stringency**: As stringent as the 2008 IECC
- **Effective Date**: March 1, 2011
- **DOE Determination/State Certification**

**COMMERCIAL**

- **Commercial Code**: ASHRAE 90.1-2007
- **MI Amendments**
- **Approved Compliance Tools**: Can use COMcheck
- **Approximate Stringency**: As stringent as ASHRAE 90.1-07
- **Effective Date**: March 1, 2011
- **DOE Determination/State Certification**

Code Status: Residential

Residential State Energy Code Status
AS OF MARCH 9, 2011

NOTE:
These maps reflect only mandatory statewide codes currently in effect.

http://bcap-ocean.org/code-status-residential

Date visited: 2/11/2011
Code Status: Commercial

Commercial State Energy Code Status
AS OF MARCH 9, 2011

NOTE: These maps reflect only mandatory statewide codes currently in effect.
Michigan Code Status


Date visited: 3/15/2011
2009 Michigan Uniform Energy Code (MUEC)
PART 10
MICHIGAN UNIFORM ENERGY CODE

R 408.31059  Applicable code.

Rule 1059. The provisions of the international energy conservation code, 2009 edition, except for sections 102.1.1, 107.2 to 107.5, 301.2, 301.3, 402.3.2, 501.1, to 506.6.2 and Tables 303.1.3(3), 502.1.2, 502.2(1), 502.2(2), 502.3, 502.4.4, 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6), 503.2.3(7), 503.2.8, 503.2.10.1(1), 503.2.10.1(2), 503.3.1(1), 503.3.1(2), 504.2, 505.5.2, 505.6.2(1), 505.6.2, 505.6.2(2), 506.5.1(1), 506.5.1(2), 506.5.1(3), 506.5.1(4), and 506.6.1(5) govern the energy efficiency for the design and construction of residential buildings and, with exceptions noted, the international energy conservation code is adopted by reference in these rules. All references to the international building code, international residential code, international energy conservation code, international electrical code, international existing building code, international mechanical code, and international plumbing code mean the Michigan building code, Michigan residential code, Michigan uniform energy code, Michigan electrical code, Michigan rehabilitation code for existing buildings, Michigan mechanical code, and Michigan plumbing code respectively.

The Michigan uniform energy code is available for inspection or purchase at the Okemos office of the Michigan Department of Energy, Labor and Economic Growth, Bureau of Construction Codes, 2501 Woodlake Circle, Okemos, Michigan 48864, at a cost as of the time of adoption of these rules of $38.00 or may be purchased from the International Code Council, 500 New Jersey Avenue, N.W., 6th Floor, Washington, D.C. 20001.
Relationship Between IRC and IECC

- IECC addresses only energy

- IRC addresses all codes (structural, plumbing, etc.)
  - Allows builder to carry only one code book
  - Chapter 11 covers energy (replaced by MUEC)

- IECC addresses both residential and commercial; IRC addresses detached one- and two-family dwellings and townhouses

- IRC allows compliance with IECC as an alternative to Chapter 11

- Energy requirements in IRC and IECC almost identical
  - IRC requires 0.35 SHGC in Climate Zones 1-3; IECC requires 0.30

New for the 2009 MUEC

• No longer allows for mechanical system trade-offs
• Drops the Abbreviated Report Form N1107.1
• Requires 50% of the lighting to be high efficacy (refer to definition section)
• Slight modifications to R-values for walls and ceilings
• Adds rigor to air barrier and air sealing requirements
• Adds rigor to inspection criteria
• Above-code programs, such as HERS and Energy Star, not clear

New for the 2009 MUEC

• Michigan amendments are primarily administrative in nature changing the title of the code from the International Energy Conservation Code (IECC) to the Michigan Uniform Energy Code (MUEC)

• Eliminated references to requirements which do not apply to Michigan, such as:
  – Climate zones 1-4
  – SHGC references

• There are some minor technical amendments, such as:
  – Recessed light fixtures installed in insulated ceilings
  – Reductions in R-value for full insulation over wall double-top plate
  – Reroofing under certain limited circumstances

Demonstrate Compliance

Prescriptive

“Prescriptive Packages Approach”

Trade-off

“Trade-off Approach” (UA)

Performance

“Performance Approach”

Code Compliance Software Tools

- **Prescriptive**: None Needed
- **Total Building “UA” Trade Off**: REScheck Software (Web-based & Desktop)
- **Energy Analysis**: Software
  - For example:
    - REM/Design
    - REM/Rate
    - EnergyGauge

Structure of the 2009 MUEC Residential

Based on IECC 2009 with Michigan Amendments

- **Chapter 1: Administration, Scope, and Application**
  - Some MI amendments
- **Chapter 2: Definitions**
  - Mostly untouched, but with amendments to the definition of ‘building’ and ‘code/building officials’
- **Chapter 3: Climate Zones**
  - Largely replaced by MI amendments adjusting climate zones
- **Chapter 4: Residential Energy Efficiency**
  - Some detailed MI amendments
- **Chapter 5: Commercial Energy Efficiency**
  - Replaced by ASHRAE 90.1—2007
- **Chapter 6: Reference Standards**
Overview of Residential Code Requirements

• Focus is on building envelope
  – Ceilings, walls, windows, floors, foundations
  – Sets insulation levels and window U-factors
  – Infiltration control—caulk and seal to prevent air leaks

• Ducts—seal and insulate

• Limited space heating, air conditioning, and water heating requirements
  – Federal law sets most equipment efficiency requirements, not the I-codes

• No appliance requirements

• Lighting equipment—50% of lamps to be high-efficacy lamps

Space Conditioning

Any non-conditioned space that is altered to become conditioned space shall be required to be brought into full compliance with this code.

http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter/graphic/231

Date visited: 11/30/2010
Chapter 1: Administration

Part 1: Scope and Application

Section 101: Scope and General Requirements

- Defines scope of the energy code
- Application:
  - New buildings
  - 101.4.1: Existing Buildings
  - 101.4.2: Historic Buildings
  - 101.4.3: Additions, Alterations, Renovations, and Repairs
  - 101.4.4: Changes in Use/occupancy
  - 101.4.5: Changes in Space conditioning
  - 101.4.6: Mixed Occupancies
Chapter 1: Administration

101.4.3: Additions, Alterations, Renovations, Repairs:

- Conform as relates to new construction
- Unaltered portions do not need to comply
- Additions can comply alone or in combination with existing building

Exceptions:
- Storm windows over existing fenestration
- Glass only replacements
- Exposed, existing ceiling, wall or floor cavities if already filled with insulation
- Where existing roof, wall or floor cavity isn’t exposed
- Reroofing for roofs where neither sheathing nor insulation exposed
  - Insulate above or below the sheathing
  - Roofs without insulation in the cavity
  - Sheathing or insulation is exposed

Chapter 1: Administration

101.4.3: Exceptions to Meeting Thermal Building Envelope Provisions:

- Very low energy use buildings (<3.4 Btu/h-ft\(^2\) or 1 watt/ft\(^2\))
- Buildings (or portions of) that are neither heated nor cooled
- Existing buildings (Section 101.4.1)
  - Electrical power, lighting, and mechanical systems still apply
- Buildings designated as historic (Section 101.4.2)

Chapter 1: Administration

101.4.6: Mixed-use Occupancies:

• Treat the residential occupancy under the applicable residential code
• Treat the commercial occupancy under the commercial code

Chapter 1: Administration

101.5: compliance

Meet the provisions of chapter 4
- 101.5.1: Computer Simulations
- 101.5.2: Low Energy Buildings
  - Exempted if less than 3.4 BTH/hr sf$^2$ and buildings without conditioned spaced


Date visited: 12/15/2010
Chapter 1: Administration

Section 102: Alternate Materials—Method of Construction, Design, or Insulating Systems

Not intended to prevent materials, methods, design, or insulating systems not specifically prescribed provided the method has been improved by the code official as meeting the intent.

Chapter 1: Administration

Section 103: Construction Documents

Construction documents, special inspections, structural programs, other data shall meet:

- Submitted in one or more sets with each application for permit
- Prepared by or under direct supervision of a registered design professional when required by 1980 PA 299
- Building official authorized to require additional construction documents for special conditions


Date visited: 12/15/2010
Chapter 1: Administration

103.2: Information on Construction Documents:

Beyond standard plan and detail information for the energy code, documents must show insulation materials, R-values, fenestration U factors, area-weighted U factors, mechanical system design criteria, mechanical and service water heating system and equipment types, sizes and efficiency, duct sealing, duct and pipe insulation, lighting fixture schedule with wattage and controls, air sealing details (see 103.2 for comprehensive list)

Chapter 1: Administration

Sec103: Construction Documents

- 103.3 through 103.5: Discussion of approvals

Chapter 1: Administration

Section 104: Inspections
- Language similar to IRC provisions

Section 105: Validity

Section 106: Reference Standards
- Refers reader to Chapter 6

Section 107: Fees (amended by MI)

Section 108: Stop Work Order
- Similar to IRC

Section 109: Board of Appeals
- Similar to IRC (amended by MI)
Chapter 2: Definitions

• Largely untouched, but with amendments to definition of ‘building’ and ‘code/building officials’

• Michigan definition of ‘Building’ excludes agricultural structures not used for retail business

• ‘Building Official’ references R408.30499
Chapter 3: Climate Zones

Section 301: Climate Zones

• Replaced by MI amendments adjusting climate zones
• Climate zones taken from figures 301.1, 301.1A and Table 301.1

Presenter’s Note: Some counties are now in new climate zones—Upper Peninsula now includes 6A and 7 and some counties have moved to (6A) from former Zone 2

Presenter’s Note: The 2003 MUEC is based upon climate zones 1, 2 and 3. The new MUEC re-labels these as 5A, 6A and 7.
U.S. Climate Zones—2009 IECC

The State of Michigan is divided into 3 climate zones:

<table>
<thead>
<tr>
<th>Zone Number</th>
<th>Thermal Criteria</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A</td>
<td>$5400 &lt; \text{HDD65°F} \leq 7200$</td>
<td>$3000 &lt; \text{HDD18°C} \leq 4000$</td>
</tr>
<tr>
<td>6A</td>
<td>$7200 &lt; \text{HDD65°F} \leq 9000$</td>
<td>$4000 &lt; \text{HDD18°C} \leq 5000$</td>
</tr>
<tr>
<td>7</td>
<td>$9000 &lt; \text{HDD65°F} \leq 12600$</td>
<td>$5000 &lt; \text{HDD18°C} \leq 7000$</td>
</tr>
</tbody>
</table>

For SI: °C = [°F - 32]/1.8


Date Visited: 11/30/2010
Figure 301.1A: Climate Zones

2009 Michigan Uniform Energy Code
Figure 301.1a

Date Visited: 11/30/2010
Table 301.1: Climate Zones by County

<table>
<thead>
<tr>
<th>Zones</th>
<th>5A</th>
<th>6A</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegan</td>
<td>Alcona</td>
<td>Baraga</td>
<td></td>
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<tr>
<td>Barry</td>
<td>Alger</td>
<td>Chippewa</td>
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<tr>
<td>Bay</td>
<td>Alpena</td>
<td>Gogebic</td>
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<tr>
<td>Berrien</td>
<td>Antrim</td>
<td>Houghton</td>
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<tr>
<td>Branch</td>
<td>Arenac</td>
<td>Iron</td>
<td></td>
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<tr>
<td>Calhoun</td>
<td>Benzie</td>
<td>Keweenaw</td>
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<tr>
<td>Cass</td>
<td>Charlevoix</td>
<td>Luce</td>
<td></td>
</tr>
<tr>
<td>Clinton</td>
<td>Cheboygan</td>
<td>Mackinac</td>
<td></td>
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<tr>
<td>Eaton</td>
<td>Clare</td>
<td>Ontonagon</td>
<td></td>
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<tr>
<td>Genesee</td>
<td>Crawford</td>
<td>Schoolcraft</td>
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<tr>
<td>Gratiot</td>
<td>Delta</td>
<td></td>
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<tr>
<td>Hillsdale</td>
<td>Dickinson</td>
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<tr>
<td>Ingham</td>
<td>Emmet</td>
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<tr>
<td>Ionia</td>
<td>Gladwin</td>
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<tr>
<td>Jackson</td>
<td>Grand Traverse</td>
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<tr>
<td>Kalamazoo</td>
<td>Huron</td>
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<tr>
<td>Kent</td>
<td>Iosco</td>
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<tr>
<td>Lapeer</td>
<td>Isabella</td>
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<tr>
<td>Lenawee</td>
<td>Kalakaska</td>
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<tr>
<td>Livingston</td>
<td>Lake</td>
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<tr>
<td>Maribb</td>
<td>Leelanau</td>
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<tr>
<td>Midland</td>
<td>Manistee</td>
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<tr>
<td>Monroe</td>
<td>Marquette</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montcalm</td>
<td>Mason</td>
<td></td>
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<tr>
<td>Muskegon</td>
<td>Mecosta</td>
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<tr>
<td>Oakland</td>
<td>Menominee</td>
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<tr>
<td>Ottawa</td>
<td>Missaukee</td>
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<tr>
<td>Saginaw</td>
<td>Montmorency</td>
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<tr>
<td>Shiawassee</td>
<td>Newaygo</td>
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<tr>
<td>St. Clair</td>
<td>Oceana</td>
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<tr>
<td>St. Joseph</td>
<td>Ogemaw</td>
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<tr>
<td>Tuscola</td>
<td>Osceola</td>
<td></td>
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<tr>
<td>Van Buren</td>
<td>Oscoda</td>
<td></td>
<td></td>
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<tr>
<td>Washtenaw</td>
<td>Otsego</td>
<td></td>
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<tr>
<td>Wayne</td>
<td>Presque Isle</td>
<td>Roscommon</td>
<td></td>
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<tr>
<td></td>
<td>Sanilac</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wexford</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key: A – Moast. Absence of moisture designation indicates moisture regime is irrelevant.

Date Visited: 11/30/2010
Chapter 3: Climate Zones

Section 302: Design Conditions

Maximum 72°F heating
Minimum 75°F cooling
Section 303: Material Systems and Equipment

303.1: Identification
• Material systems and equipment must be identified in a manner that will allow determination of compliance

303.1.1: Building Thermal Envelope and Insulation
• Identification mark must be applied by the manufacturer to each piece of thermal envelope insulation 12” or greater in width
• Alternatively, the insulation installer shall provide a certification listing the type, manufacturer, and R-value of insulation
• For blown or sprayed insulation, the initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags shall be listed on the certification
• For sprayed polyurethane foam insulation, installed thickness of areas covered, and R-values of installed thickness shall be listed on the certification. Installer must sign, date and post the certification in a conspicuous location
303.1.1: Blow or sprayed roof ceiling insulation

- Thickness of blown and/or sprayed insulation shall be written in inches on markers that are installed at least one for every 300 sf throughout the attic space.
- Marker shall be affixed to trusses or joists and marked with a minimum initial installed thickness with numbers a minimum of 1 inch in height.
Section 303: Material Systems and Equipment

303.1.2: Insulation Mark Installation

- Insulating material shall be installed such that manufacturer’s R-value mark is readily observable upon inspection

Presenter’s Note: Because of increased emphasis on compliance, many jurisdictions will go to insulation inspections
Chapter 3: Climate Zones

303.1.4: Insulation Product Rating

• R-value must be determined in accordance with CFR Title 16 Part 460, May 31st, 2005 at mean temperature 75°F
Chapter 3: Climate Zones

303.1.4: Insulation Product Rating

• New labeling requirements for fixed wall insulation
  - Compressing cotton, polyester, fiberglass, or mineral wool batts
    • Must have labeling on batt for compressed R-value

• Currently information is on packaging material per FTC requirements

303.1.3: Fenestration Product Rating

- U factors of fenestration products (windows, doors, and skylights) shall be determined in accordance with NFRC 100, labeled and certified.
- Product lacking such certification must use default values from Table 303.1.3 (1), 303.1.3 (2).
- For example: a vinyl clad wood double-glazed window without certification would have to use the default U value of 0.55 from Table 303.1.3 (1).

303.1.3: *Fenestration Product Rating*

- Michigan has added an exception for computer simulations by independent NFRC certified laboratories as an alternative for use of the default values from Tables 303.1.1(1) and 303.1.3(2)
Chapter 3: Climate Zones

303.2: Installation

- Must be installed in accordance with manufacturer’s instructions
- Must be installed in accordance with International Building Code (IBC)

Presenter’s Note: MBC and MRC
Chapter 4: Residential Energy Efficiency

401.1: Scope

- Applies to residential buildings
- Commercial buildings covered under the commercial code based on ASHRAE 90.1—2007 (excludes low-rise residential up to 3 stories)

Section 401: General

401.1: Scope:

- IRC only for single-family, duplex, and townhouses
- IECC has all low-rise (1-3 stories) houses, condos, and apartments [R-2, R-3, R-4], but not hotels/motels [R-1]
- All buildings that are not “residential” by definition are “commercial”

Includes repairs, alterations, and additions
e.g., window replacements

401.2: Compliance

Projects must comply with certain mandatory provisions

• 401.2.4: Air Leakage
• 402.5: Maximum U values: Fenestration
• 403.1: Controls
• 403.2.2: Duct Sealing
• 403.2.3: Building Cavities
• 403.3 through 403.9: referred to as mandatory

• Must comply with either:
  – Prescriptive (402.1 – 402.3, 403.2.1 and 404.1)
  – Performance (Section 405)
Section 401: General

401.3: Certificate

- Permanently posted on the electrical distribution panel
- Don’t cover or obstruct the visibility of other required labels
- Includes the following:
  - R-values of insulation installed for the thermal building envelope including ducts outside conditioned spaces
  - U-factors for fenestration
  - HVAC efficiencies and types
  - SWH equipment

Section 401: General

401.3: Certificate (continued)

• If a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed
  − Certificate lists gas-fired unvented room heater, electric furnace or baseboard electric heater
• No efficiency listed for the above systems

Section 402: Building Thermal Envelope

402.1: General Prescriptive

• 402.1.1: Insulation and Fenestration Criteria

Additions

### TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT U-FACTOR</th>
<th>CEILING R-Value</th>
<th>WOOD FRAME WALL R-VALUE</th>
<th>MASS WALL R-VALUE</th>
<th>FLOOR R-VALUE</th>
<th>BASEMENT WALL R-VALUE</th>
<th>SLAB R-VALUE AND DEPTH</th>
<th>CRAWL SPACE WALL R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A</td>
<td>0.35</td>
<td>0.60</td>
<td>38</td>
<td>20 or 13 + 5(^{a})</td>
<td>13/17</td>
<td>30(^{d})</td>
<td>10/13</td>
<td>10, 2ft</td>
<td>10/13</td>
</tr>
<tr>
<td>6A</td>
<td>0.35</td>
<td>0.60</td>
<td>49</td>
<td>20 or 13 + 5(^{a})</td>
<td>15/19</td>
<td>30(^{d})</td>
<td>15/19</td>
<td>10, 4ft</td>
<td>10/13</td>
</tr>
<tr>
<td>7</td>
<td>0.35</td>
<td>0.60</td>
<td>49</td>
<td>21</td>
<td>19/21</td>
<td>38(^{d})</td>
<td>15/19</td>
<td>10, 4ft</td>
<td>10/13</td>
</tr>
</tbody>
</table>

- a. The fenestration U-factor column excludes skylights.
- b. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- c. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less, in zones 1-3 for heated slabs.
- d. Or insulation sufficient to fill the framing cavity, R-19 minimum.
- e. “13+5” means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
- f. The second R-value applies when more than half the insulation is on the interior.

From DELEG Construction Code Part 10 Michigan Uniform Energy Code

Additions:

• Treat as a stand-alone building
• Additions must meet the prescriptive requirements in Table 402.1.1
402.1.2: R-value Computation

• Insulation components only
• Do not include other building materials or air films
Section 402: Building Thermal Envelope

402.1.3: U-Factor Alternative

- Maximum U-factors from Table 402.1.3

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Fenestration U-Factor</th>
<th>Skylight U-Factor</th>
<th>Ceiling U-Factor</th>
<th>Frame Wall U-Factor</th>
<th>Mass wall U-Factor</th>
<th>Floor U-Factor</th>
<th>Basement Wall U-Factor</th>
<th>Crawl Space Wall U-Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A</td>
<td>0.35</td>
<td>0.60</td>
<td>0.030</td>
<td>0.057</td>
<td>0.082</td>
<td>0.033</td>
<td>0.059</td>
<td>0.065</td>
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<tr>
<td>6A</td>
<td>0.35</td>
<td>0.60</td>
<td>0.026</td>
<td>0.057</td>
<td>0.060</td>
<td>0.033</td>
<td>0.050</td>
<td>0.065</td>
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<td>7</td>
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<td>0.057</td>
<td>0.026</td>
<td>0.050</td>
<td>0.065</td>
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</tbody>
</table>

a. Nonfenestration U-factors shall be obtained from measurement, calculation, or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be the same as the frame wall U-factor in Zones 5 to 7.
c. Basement wall U-factor requirements shown in Table 402.1.3 include wall construction and interior air films, but exclude soil conductivity and exterior air films.
d. Foundation U-factor requirements shown in Table 402.1.3 include wall construction and interior air films, but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with section 402.1.4 (total UA alternative) of section 405 (simulated performance alternative) shall be modified to include soil conductivity and exterior air films.

From DELEG Construction Code Part 10 Michigan Uniform Energy Code
Section 402: Building Thermal Envelope

402.1.4: Total UA Alternative

• Use ASHRAE calculation methods
• Includes all building construction, including air films

Demonstrate Compliance: 3 Options

- **Prescriptive**
  - R-values
    - 402.1.1

- **U-Factor and “UA” Alternatives**
  - U-factor
    - 402.1.3
  - Total Building UA
    - 402.1.4

- **Simulated Performance (software)**
  - Simulated Performance Alternative
    - 405

Section 402: Building Thermal Envelope

402.2.1: Ceilings with Attic Spaces

- Raised-heel trusses (energy trusses) are allowed to reduce insulation values in climate zones 6 and 7, not in CZ 5
- R-38 is now required in CZ 5

Presenter’s note: the code is silent on whether raised-heel trusses would be required in CZ 5, however it is a ‘best practice’ (BCC will have to determine)

Section 402: Building Thermal Envelope

Ceilings:

• Requirements based on:
  − Assembly type
  − Continuous insulation
  − Insulation between framing

• Meet or exceed R-values

Standard Roof Truss

Possibility of ice dam formations

Ceiling insulation code requirements assume standard truss systems

Cold corners contribute to condensation and mold growth

Raised Heel Truss (Energy Truss)

Raised Heel/Energy Truss credit if insulation is full height over exterior wall (*Prescriptive*)

- R-38 instead of R-49

Section 402: Building Thermal Envelope

402.2.2: Ceilings without Attic Spaces

• Examples:
  − Raftered
  − Some cathedrals without attics, etc.

• Minimum R-30 (maximum 500 sf or 20% of total insulated ceiling, whichever is less)

• Shall not apply to U-factor alternative approach
Section 402: Building Thermal Envelope

402.2.3: Access Hatches and Doors

- Full ceiling insulation thickness
- Weather-stripped

**Presenter’s note:** May require special product or rigid board insulation—new thinking on details

402.2.4: Mass Walls

- Defines mass walls as concrete, concrete block, ICF, masonry cavity, brick (other than brick veneer), earth, solid timber/logs
- This definition applies when using Table 402.1.1
Section 402: Building Thermal Envelope

Mass Walls:

• Type:
  − Concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth, and solid timber/logs

• Provisions:
  − At least 50% of the required R-value must be on the exterior or integral to the wall
  − When more than half the insulation is on the interior, climate zones 5-7 require the same insulation values as above-grade walls
Section 402: Building Thermal Envelope

402.2.5: Steel-frame Ceilings, Walls and Floors

- Steel-frame buildings must meet insulation requirements of Table 402.2.5
- Must use continuous insulation over the framing members

Section 402: Building Thermal Envelope

Steel-frame

• Table 402.2.5
  – Addresses steel-frame ceiling, wall, and floor insulation required R-values
402.2.6: Floors

- Floor insulation, when required, must be in permanent contact with the underside of the subfloor decking.
Section 402: Building Thermal Envelope

Floors over unconditioned space—unheated basement, crawlspace or outdoor air

<table>
<thead>
<tr>
<th>Climate Zones</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4c-6</td>
<td>30</td>
</tr>
<tr>
<td>7-8</td>
<td>38</td>
</tr>
</tbody>
</table>

Insulation must maintain permanent contact with underside of subfloor

*Exception*: Climate Zones 4c-8 R-19 permitted if cavity completely filled
402.2.7: Basement Walls

• Insulate basements from the top of the wall from 10 ft. below grade or to the basement floor, whichever is less

• Unconditioned basements shall also meet this requirement, unless the floor overhead is insulated

303.2.1: Protection of Exposed Foundation Insulation

• Requires exterior foundation insulation to have a rigid, opaque, weather-resistant protective covering

• Must extend 6” below grade
Section 402: Building Thermal Envelope

Below-grade Wall: ≥ 50% below grade

<table>
<thead>
<tr>
<th>Climate Zones</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-5</td>
<td>10/13</td>
</tr>
<tr>
<td>6-8</td>
<td>15/19</td>
</tr>
</tbody>
</table>

Insulated from top of basement wall down to 10 ft below grade or basement floor, whichever is less

Defining Below-Grade Walls

Basement Wall - > 50% below grade

Below grade basement wall

Below grade basement wall

Exterior Wall - < 50% below grade

Below grade basement wall

402.2.8: Slab-on-grade Floors

- Insulate in accordance with Table 402.1.1
- Insulation shall extend from top of slab on outside or inside of foundation wall
- R-5 shall be added when slabs are heated, such as radiant floor slabs

Presenter’s note: May be a typographical error in footnote C—BCC needs to clarify
Section 402: Building Thermal Envelope

Slab Edge Insulation:

Slabs with a floor surface < 12 inches below grade

- R-10 (typically 2 inches) insulation in Zones 5 and above
- Downward from top of slab a minimum of 24” (Zones 5) and 48” (Zones 6 and 7)
- Insulation can be vertical or extend horizontally under the slab or out from the building (must be under 10 inches of soil)

Presenter’s note: Horizontal insulation is not approved for commercial construction.
Slab Edge Insulation

402.2.9: *Crawl Space Walls*

- As an alternative to insulating the floor above, crawl space walls may be insulated.
- See Table 402.1.1.
- Exposed earth floors must have a vapor retarder.
Unvented Crawlspace

- Space should be mechanically vented or conditioned (See Section R408 of the IRC)
- Cover exposed earth with a continuous Class I vapor retarder
Vapor Retarders

• **Vapor Retarder Class:** A measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly.
  - Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E-96 as follows:
    • Class I: 0.1 perm or less
    • Class II: 0.1 < perm < 1.0 perm
    • Class III: 1.0 < perm < 10 perm

• **Material vapor retarder class:** The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.
  - The following shall be deemed to meet the class specified:
    • Class I: Sheet polyethylene, non-perforated aluminum foil
    • Class II: Kraft faced fiberglass batts or low perm paint
      (paint with 0.1<perm<1.0)
    • Class III: Latex or enamel paint

• **Class III vapor retarders:** Class III vapor retarder shall be permitted where any one of the conditions in Table 402.5.1 are met.
Vented & Unvented Crawlspace Requirements:

**Vented Crawlspac Requirements:**

- The raised floor over the crawlspace must be insulated.
- A vapor retarder may be required as part of the floor assembly.
- Ventilation openings must exist that are equal to at least 1 square foot for each 150 square feet of crawlspace area and be placed to provide cross-flow (IRC 408.1, *may be less if ground vapor retarder is installed*).
- Ducts in crawlspace must be sealed and have R-8 insulation.

**Unvented Crawlspace Requirements:**

- The crawlspace ground surface must be covered with an approved vapor retarder (*e.g.*, plastic sheeting).
- Crawlspace walls must be insulated to the R-value requirements specific for crawlspace walls (*IECC Table 402.1.1*).
- Crawlspace wall insulation must extend from the top of the wall to the inside finished grade and then 24" vertically or horizontally.
- Crawlspace must be mechanically vented (*1 cfm exhaust per 50 square feet*) or conditioned (*heated and cooled as part of the building envelope*).
Section 402: Building Thermal Envelope

402.2.10: Masonry Veneer

- Insulation not required on the brick ledge
Section 402: Building Thermal Envelope

402.2.11: Sunrooms

Less stringent insulation
R-value and glazing
U-factor requirements

Sunroom definition:
- Glazing area >40% glazing of gross exterior wall and roof area
- Separate heating or cooling system or zone
- Must be thermally isolated (closeable doors or windows to the rest of the house)
Section 402: Building Thermal Envelope

402.2.11: Thermally Isolated Sunroom Insulation

• Minimum ceiling insulation value shall be R-25 for climate zones 5-7
• Minimum wall value shall be R-13 (all zones)
• New or existing walls, windows, and doors separating sunroom from conditioned space shall meet the building thermal envelope requirements

402.3.5: Thermally Isolated Sunroom U-factor

• Windows and door maximum U-factor of 0.5
• Skylight maximum U-factor of 0.75

Section 402: Building Thermal Envelope

402.3: Fenestration (Prescriptive)

402.3.1: U-factor
• Can use area-weighted averages to satisfy U-factor requirements

402.3.2: SHGC Requirements
• Deleted by Michigan

Presenter’s note: SHGC still required for commercial
Section 402: Building Thermal Envelope

402.5: Maximum Fenestration U-factor (Mandatory)

- Maximum U-factors for fenestration is 0.48 in CZ 5 and 0.40 in CZ 6 and 7
- Maximum values when using any of the tradeoff approaches 402.1.4 total UA alternative or computer simulations 405

Presenter’s Note: Input from later section

Section 402: Building Thermal Envelope

402.3.3: Glazed Fenestration Exemption

• Exemption for up to 15 square feet from Table 402.1.1 (does not apply if U-factor alternative approach or total UA alternative are used)

402.3.4: Opaque Door Exemption

• One side-hinged opaque door assembly up to 24 square feet is exempt from Table 402.1.1 (does not apply if U-factor alternative approach or total UA alternative are used)
Fenestration

An area weighted average of fenestration can be used to satisfy U-factor & SHGC requirements

- Area-weighted average U-factor is subject to hard limits, even in trade-offs
- NFRC rated and certified

Exceptions:
- SHGC does not apply to residential in Michigan

402.3.6: Replacement Fenestration

- When replacing total windows, must meet U-factor requirements of Table 402.1.1
Section 402: Building Thermal Envelope

Presenter’s Note: Air leakage requirements are much more elaborate and specific than under previous code.

402.4: Air Leakage (Mandatory)

402.4.1: Building Thermal Envelope

• Twelve specific locations:
  - Typical areas, such as doors, windows, utility penetrations
  - Some special areas, such as: common walls between dwelling units, behind tubs and showers on exterior walls, attic access openings
  - See Section 402.4.1 for specific list

Section 402: Building Thermal Envelope

Typical air infiltration locations:

- Windows and doors
- Between sole plates
- Floors and exterior wall panels
- Plumbing
- Electrical
- Service access doors or hatches
- Recessed light fixtures
- Rim joist junction
Section 402: Building Thermal Envelope

Air Leakage:

• Sealed with caulking materials or

• Closed with gasketing systems

• Joints and seams sealed or taped or covered with a moisture vapor-permeable wrapping material
Section 402: Building Thermal Envelope

402.4.2: Air Sealing and Insulation
• Must be demonstrated by one of the following:
  – Testing option (blower door)
  – Visual inspection option

402.4.2.1: Testing option (blower door):
• Maximum 7 ACH at 50 Pa (1 psf)
• Refer to 402.2.1 for specific testing requirements

Presenter’s Note: Earlier versions of IECC 2009 listed 33.5 psf—corrected to 1 psf in later versions
Section 402: Building Thermal Envelope

402.4.2.2: Visual Inspection Option

- Requires compliance with Table 402.4.2 and verification
- Building Official may require independent third party inspection

Visual inspection component criteria

• **Table 402.4.2**
  - Air barrier and insulation inspection checklist
  - Provides criteria for components
    • Air barrier and thermal barrier
    • Ceiling/attic
    • Walls
    • Windows and doors
    • Rim joists
    • Floors
    • Etc.
Section 402: Building Thermal Envelope

402.4.3: Fireplaces

• New wood-burning fireplaces shall have gasketed doors and outdoor combustion air
Section 402: Building Thermal Envelope

402.4.4: Fenestration Air Leakage

• Maximum infiltration rate of 0.3 cfm/sf for sliding doors
• Maximum rate of 0.5 cfm/sf for swinging doors
• NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440
• Must be listed and labeled
• Site-built windows, skylights and doors are exempt from the leakage test
Section 402: Building Thermal Envelope

Recessed Lighting Fixtures:

• Type IC rated and labeled in a sealed or gasketed enclosure
• Type IC rated and labeled as meeting ASTM E 283
• Sealed with a gasket or caulk between the housing and interior wall or ceiling covering
• Michigan provides for installation of a non-IC-rated fixture in a fire-rated box with insulation over
Section 402: Building Thermal Envelope

402.5: Maximum Fenestration U-factor (Mandatory)

Presenter’s Note: Covered under earlier fenestration discussion
Section 403: Systems

Equipment *efficiency* set by Federal law, *not* the energy code

Section 403: Systems

Mandatory Requirements:

• Controls
• Heat pump supplementary heat
• Ducts
  – Sealing
  – Insulation (Prescriptive)
• HVAC piping insulation
• Circulating hot water systems
• Ventilation
• Equipment sizing
• Systems serving multiple dwelling units
• Snow melt controls
• Pools

Section 403: Systems

403.1: Controls (Mandatory)
• At least one thermostat for each separate heating and cooling system

403.1.1: Programmable Thermostat
• For forced-air furnaces, at least one programmable thermostat
  − Daily schedule
  − Different temperature set points
  − Temperature setback
  − Initial settings of 70°F heating and 78°F cooling

Section 403: Systems

403.1.2: Heat Pump Supplementary Heat (Mandatory)

• If heat pump is capable of meeting the load, supplementary electric resistance heat is prohibited, except during defrost
Section 403: Systems

403.2: Ducts

403.2.1: Insulation (Prescriptive)

• Supply ducts in attics must have R-8 insulation
• All other ducts must have R-6 insulation
• Exception: ducts located completely inside building thermal envelope

Presenter’s Note: Highly recommend full envelope insulation over attic ductwork

Section 403: Systems

403.2.2: Sealing (Mandatory)

- All ducts, air handlers, filter boxes and building cavities used as ducts must be sealed in accordance with the Michigan Residential Code (M1604.1)
- Joints of ducts shall be sealed with tapes, mastics, liquid sealants, gasketing, or other approved closure systems

Presenter’s Note: BCC will need to confirm based on MRC 2009 (IRC 2009). No duct tape.
Section 403: Systems

Duct Insulation and Sealing:

403.2.1: Insulation (Prescriptive)
- Ducts outside the building envelope: R-8
- All other ducts: R-6

403.2.2: Sealing (Mandatory)
- Joints and seams shall comply with IRC, Section M1601.4.1

• Building framing cavities shall not be used as supply ducts
Residential HVAC: Duct Location

- Ducts in *un-conditioned* space:

- Ducts in *conditioned* space:
Section 403: Systems

• For piping carrying fluids above 105°F or below 55°F, must be insulated to minimum of R-3
Section 403: Systems

403.3: Mechanical System Piping Insulation (Mandatory)

- R-3 required on HVAC systems
  - *Exception*: Piping that conveys fluids between 55 and 105°F
- R-2 required on
  - All circulating domestic hot water systems
    - Systems also require a readily accessible manual switch

*Michigan exceptions:*
- Factory-installed piping within HVAC equipment
- Run-out piping 4 ft or less
Section 403: Systems

403.5: Mechanical Ventilation (Mandatory)

• Outdoor intakes and exhaust must have automatic or gravity dampers
Section 403: Systems

403.6: Equipment Sizing (Mandatory)

- Heating and cooling equipment must be sized in accordance with the International Residential Code
- Load calculations determine the proper capacity (size) of equipment
  - Goal is big enough to ensure comfort but no bigger
- Calculations shall be performed in accordance with ACCA Manual J or other approved methods

Presenter’s Note: Should refer to MRC, not IRC
Section 403: Systems

403.7: Systems Serving Multiple Dwelling Units (Mandatory)

Presenter’s Note: Michigan has deleted sections 503 and 504—BCC to verify

Section 403: Systems

403.8: *Snow Melt Systems (Mandatory)*

Snow- and ice-melting system controls

- pavement temperature > 50°F and no precipitation is falling and when the outdoor temperature is > 40°F

http://www.radiantheatchicago.com/snowmelt.html  Date visited: 11/30/2010
Section 403: Systems

403.9: Pools (Mandatory)

- Pools shall be provided with energy conserving features
  - Pool heater requirements
  - Time switch requirements
  - Pool cover requirements

http://www.fillionassociates.com/products_pool_cover_systems.htm  Date visited: 11/30/2010
404.1: Lighting Equipment

Minimum of 50% of lamps shall be high efficacy

- T8 or smaller diameter
  - > 40 watts: 60 lumens per watt
  - 15-40 watts: 50 lumens per watt
  - < 15 watts: 40 lumens per watt

Section 405: Simulated Performance Alternative (Performance)

• Provides for computer simulation as an alternative to the prescriptive approach

• Requires computer software with specified capabilities (local official may approve other tools)

• Includes both envelope and equipment

• Allows greatest flexibility—credits features such as:
  - High efficiency furnaces, air-conditioners, etc.
  - Tight ducts (must be leak tested) or hydronic systems
  - Exterior shading, favorable orientation, thermal mass, SHGC, etc.

• Section 405 specifies “ground rules”
  - These will generally be “hidden” in compliance software calculation algorithms
  - Very similar ground rules are used in home federal tax credits and ENERGY STAR Home guidelines
Simulated Performance Alternative

Software Options:

http://www.nrel.gov/buildings/energy_analysis.html

http://blog.anglianhome.co.uk/company-news/unique-thermal-view-website-highlights-energy-efficiency-in-ipswich-homes/

Date visited: 11/30/2010
What Does This Mean to Me?


Target Codes:

• Residential: 2009 IECC
• Commercial: ASHRAE 90.1-2007

90% compliance within 8 years
One time demonstration of 90% compliance required

BECP is developing guidelines and tools to use in measuring compliance with building energy codes, which:

- Foster uniformity and objectivity in measuring compliance rates
- Eliminate need for each state to develop its own procedures and tools
- Provide tools that states can adapt for their own preferred use
- Collect additional data and support related activities.
PNNL Topic Briefs

• Brief 1: Measuring 90% Compliance
• Brief 2: Sample Size
• Brief 3: Onsite Compliance Evaluation
• Brief 4: Above-Code Programs
• Brief 5: Sample Distribution and Makeup
• Brief 6: Evaluation Checklists
• Brief 7: Compliance Roadmap
• Brief 8: Renovations
• Brief 9: Alternative Codes
• Period of Evaluation
• Annual Measurement Requirements
• Approaching Jurisdictions
• Training and Tools
• Related Outcomes

Measuring State Energy Code Compliance Report:

• Aggregate of previously released energy code compliance topic briefs and additional information on remaining topics

• 74 page document
  – Code adoption and equivalency
  – Annual measurement
  – Planning for compliance
  – Evaluation
  – Onsite compliance evaluation procedures (includes generating the sample sets)
  – Evaluation checklists

Evaluated buildings are each assigned a compliance rating of 0–100% based on the proportion of code requirements that each has met, and the evaluated buildings’ scores within a state are averaged to derive an overall compliance metric with an associated confidence.
## Residential Data Collection Checklist

### 2009 International Energy Conservation Code

**Climate Zone 3**

**Date:**

**Name of Evaluator(s):** 

**Building Name & Address:**

**Conditioned Floor Area:** ft²

**Building Contact:**

**Phone:**

**Email:**

**Compliance Approach:**

- [ ] Prescriptive (402.1.2 or 402.1.3)
- [ ] UA Trade-Off (402.1.4)
- [ ] Building Performance (405)

**State:**

**Jurisdiction:**

**Building Type:**

- [ ] 1- and 2-Family, Detached
- [ ] Single Family
- [ ] Multifamily
- [ ] Apartment

**Project Type:**

- [ ] New Construction
- [ ] Addition to existing building

### Table: Pre-Inspection/Plan Review

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Pre-Inspection/Plan Review</th>
<th>Code Value</th>
<th>Verified Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR1 [103.2]</td>
<td>Construction drawings and documentation submitted and available. Documentation sufficiently demonstrates energy code compliance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR2 [403.6]</td>
<td>HVAC loads calculations: Heating system size(s): kBtu: __, Cooling system size(s): kBtu: __</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments: ________________________________**

### Item Specific Requirements

**PR1 [103.2]:**
- **Documentation.** Determine if a complete set of plans/construction drawings, specifications, and energy code compliance documentation is available in the building department. If there is no building department or the locality does not conduct plan review, this information should be obtained from the registered design professional or builder having responsibility for the project. If documentation indicating a trade-off or performance approach is not provided, a prescriptive approach must be assumed for verifying compliance. Construction documents should sufficiently demonstrate energy code compliance, including but not limited to the following information:
  - The location and R-values of insulation materials
  - U-factors and SHGC values for windows, doors, skylights, and other fenestration products
  - Information related to duct and piping location, insulation type and R-value, and means of sealing

Under the assumption that only state or local government with a responsible enforcement and/or permitting agency are included in compliance evaluations, plans and documentation are expected to be held by the responsible agency. If this is not the case, mark this code requirement and the next (PR1 and PR2) as non-compliant, unless there is another entity responsible for enforcement identified (e.g. utility, contractor licensing board, etc.) in which case they should be contacted to review PR1 and PR2 information.

**PR2 [403.6]:**
- **HVAC Load Calculations.** Verify that HVAC load calculations have been completed and submitted. Verify the methodology used in the load calculations. List the resultant heating and/or cooling loads as applicable in the Verified Value column.
Building Energy Codes Resource Guide:  
*Code Officials Edition*

View or download:  
http://www.energycodes.gov/publications/resourceguides/

- Plan review and inspection resources  
- REScheck and COMcheck reference guides  
- Case studies  
- Sample checklists

• Download the PDF or flip through the online version  
• Register for automatic updates


To support greater compliance with energy codes, the U.S. Department of Energy's Building Energy Codes Program (BECP) and the International Code Council (ICC) have collaborated to publish a collection of each organization’s most useful resources for code enforcement officials.

The guide includes practical plan review and inspection resources, including BECP's REScheck™ and COMcheck™ quick reference guides, case studies, and sample inspection checklists; as well as extracts from ICC's commentaries, workbooks, and code companion materials.

This collection also includes many other helpful items and points to further resources available on the web. Residential and commercial building officials can easily add state and local guidance in order to use this binder as a one-stop resource to support compliance in the field.

Take a Tour!

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# Compliance Evaluation

## Residential Data Collection Checklist

### 2009 International Energy Conservation Code

**Climate Zone 3**

<table>
<thead>
<tr>
<th>Date:</th>
<th>Name of Evaluator(s):</th>
</tr>
</thead>
</table>

### Building Name & Address:__________________________________________ Conditioned Floor Area:_______ ft²

### Building Contact: Name:________________ Phone:_________ Email:_________________

### Compliance Approach: □ Prescriptive (402.1.2 or 402.1.3) □ UA Trade-Off (402.1.4) □ Building Performance (405)

### State:_________ Jurisdiction:__________________

### Building Type:

- □ 1- and 2-Family, Detached: □ Single Family □ Mobile □ Manufactured
- □ Multifamily: □ Apartment □ Condominium

### Project Type:

- □ New Construction □ Addition to existing building □ Existing building renovation

## Residential Checklist Inspection Stages

- **Plan Review**
  - Foundation
  - Framing/Rough-In
  - Insulation
- **Final**

---

# Residential Data Collection Checklist

**2009 International Energy Conservation Code**  
**Climate Zone 3**

<table>
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**Conditioned Floor Area:** ft²

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**Phone:**  
**Email:**  

**Compliance Approach:**  
- [ ] Prescriptive (402.1.2 or 402.1.3)  
- [ ] UA Trade-Off (402.1.4)  
- [ ] Building Performance (405)

**State:**  
**Jurisdiction:**  

**Building Type:**  
- [ ] 1- and 2-Family, Detached  
- [ ] Single Family  
- [ ] Modular  
- [ ] Townhouse  
- [ ] Multifamily  
- [ ] Apartment  
- [ ] Condominium

**Project Type:**  
- [ ] New Construction  
- [ ] Addition to existing building  
- [ ] Existing building renovation

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<td>kBtu:</td>
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## Compliance Evaluation

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<th>Foundation Inspection</th>
<th>Code Value</th>
<th>Verified Value</th>
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<th>N/A</th>
<th>Comments/Notes/Findings</th>
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<tbody>
<tr>
<td>FO1</td>
<td>Slab edge insulation R-value. Installed per manufacturer’s instructions.</td>
<td>Unheated: R-0, Heated: R-5</td>
<td>R-_____</td>
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<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO2</td>
<td>Slab edge insulation depth/length</td>
<td>Heated: 2 ft.</td>
<td>____ ft.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO3</td>
<td>Basement wall exterior insulation R-value. Installed per manufacturer’s instructions.</td>
<td>R-5</td>
<td>R-_____</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO4</td>
<td>Basement wall exterior insulation depth</td>
<td>10 ft. or to basement floor</td>
<td>____ ft.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO5</td>
<td>Crawl space wall insulation R-value. Installed per manufacturer’s instructions.</td>
<td>R-5 (cont.), R-13 (cavity)</td>
<td>R-_____</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO6</td>
<td>Snow melt controls</td>
<td></td>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>FO7</td>
<td>Insulation protection</td>
<td></td>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>
Foundation Insulation

- Insulation can be cut at 45 degree angle
- Verify R-values

| FO1 [402.2.8, 303.2]¹ | Slab edge insulation R-value. Installed per manufacturer’s instructions. |

- After back fill
Slab Insulation

<table>
<thead>
<tr>
<th>FO2 [402.2.8]</th>
<th>Slab edge insulation depth/length</th>
</tr>
</thead>
</table>

House

Basement Slab

House

Slab or Grade

Best Practice
FO3 [402.1.1, 303.2]¹ Basement wall exterior insulation R-value. Installed per manufacturer’s instructions.
FO4 [402.2.7][1]  Basement wall exterior insulation depth
Crawl space wall insulation R-value. Installed per manufacturer’s instructions.

FO5 [402.2.9, 303.2]¹
Insulation Protection

| FO7 [303.2.1]^2 | Insulation protection |

## Framing/Rough-in Inspection

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Framing / Rough-In Inspection</th>
<th>Code Value</th>
<th>Verified Value</th>
<th>Complies</th>
<th>Comments/Notes/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR1 [402.1.1, 402.2.5, 402.2.6, 303.2]</td>
<td>Floor insulation R-value (requirement varies depending on floor type). Installed per manufacturer's instructions.</td>
<td>R-13 (wood), (steel)²</td>
<td>R-_____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR2 [402.1, 402.3.3, 402.3.5]</td>
<td>Glazing U-factor (including sunrooms)³</td>
<td>Sunrooms: U-0.5⁴ Other: U-0.5⁵</td>
<td>U-_____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR3 [402.1, 402.3.5]</td>
<td>Skylight U-factor (including sunrooms)³</td>
<td>U-0.65</td>
<td>U-_____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR4 [303.1.3]</td>
<td>NFRC labels present</td>
<td></td>
<td></td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR5 [402.1.2, 402.3.3]</td>
<td>Glazing SHGC value³</td>
<td>SHGC: 0.3 0.5 maximum⁶</td>
<td>SHGC: _____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR6 [402.1.1, 303.2]</td>
<td>Mass wall exterior insulation R-value. Installed per manufacturer's instructions.</td>
<td>R-5⁷</td>
<td>R-_____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR7 [403.2.1]</td>
<td>Duct insulation</td>
<td>R-8 (attic supply) R-6 (other)</td>
<td>R-_____</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR8 [403.2.2]</td>
<td>Duct sealing complies with listed sealing methods</td>
<td></td>
<td></td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR9 [403.2.2]</td>
<td>Duct tightness testing</td>
<td>8 cfm (to outdoors) 12 cfm</td>
<td>_____ cfm</td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
<tr>
<td>FR10</td>
<td>Building insulation NOT used for</td>
<td></td>
<td></td>
<td>☐ ☐ ☐</td>
<td></td>
</tr>
</tbody>
</table>
Floor Insulation

Floor insulation R-value (requirement varies depending on floor type). Installed per manufacturer’s instructions.

FR1 [402.1.1, 402.2.5, 402.2.6, 303.2]¹

Determine and record the U-factor(s) for the window, door, and glass block assemblies installed in the building envelope that are not skylights (e.g., are at least 15 degrees from vertical), including fenestration assemblies installed in a sunroom that is thermally isolated from the rest of the building.

<table>
<thead>
<tr>
<th>FR2 [402.1, 402.3.3, 402.3.5]^1</th>
<th>Glazing U-factor (including sunrooms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR3 [402.1, 402.3.5]^1</td>
<td>Skylight U-factor (including sunrooms)^3</td>
</tr>
<tr>
<td>FR4 [303.1.3]^1</td>
<td>NFRC labels present</td>
</tr>
<tr>
<td>FR5 [402.1.2, 402.3.3]^1</td>
<td>Glazing SHGC value^4</td>
</tr>
</tbody>
</table>
Mass Wall Insulation and Installation

Mass wall exterior insulation R-value. Installed per manufacturer’s instructions.

FR6 [402.1.1, 303.2]
Duct Insulation

FR7 [403.2.1]¹ | Duct insulation

Duct Leaks

Courtesy: WSU Extension Energy Program

Duct Sealing

Ducts, air handlers, filter boxes, and building cavities used as return air ducts have joints and seams sealed.

FR8 [403.2.2]\(^1\)  
Duct sealing complies with listed sealing methods.

Building Cavities as Supply Ducts

FR10 [403.2.3]¹

Building cavities NOT used for supply ducts

## HVAC Piping Installation

<table>
<thead>
<tr>
<th>FR11 [403.3]$^2$</th>
<th>HVAC piping insulation</th>
</tr>
</thead>
</table>

*Residential Evaluator Training. Building Energy Codes University. (2010)*
### Outdoor Intake/Exhaust Openings

<table>
<thead>
<tr>
<th>FR12 [403.5]$^2$</th>
<th>Dampers Installed on all outdoor Intake and exhaust openings</th>
</tr>
</thead>
</table>

*Residential Evaluator Training. Building Energy Codes University. (2010)*
| FR13 [403.4]$^2$ | Circulating hot-water piping insulation |

*Residential Evaluator Training. Building Energy Codes University. (2010)*
Recessed Lighting Fixtures

Recessed lighting fixtures meet infiltration criteria

FR14 [402.4.5]²

Recessed lighting fixtures meet infiltration criteria
Fenestration and Door Air Leakage

<table>
<thead>
<tr>
<th>World's Best Window Co.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millennium 2000(^+)</td>
</tr>
<tr>
<td>Vinyl-Clad Wood Frame</td>
</tr>
<tr>
<td>Double Glazing • Argon Fill • Low E</td>
</tr>
<tr>
<td>Product Type: Vertical Slider</td>
</tr>
</tbody>
</table>

**ENERGY PERFORMANCE RATINGS**

<table>
<thead>
<tr>
<th>U-Factor (U.S./I-P)</th>
<th>Solar Heat Gain Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

**ADDITIONAL PERFORMANCE RATINGS**

<table>
<thead>
<tr>
<th>Visible Transmittance</th>
<th>Air Leakage (U.S./I-P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.51</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer’s literature for other product performance information. www.nfrc.org

FR15 [402.4.4]\(^2\)

<table>
<thead>
<tr>
<th>Glazed fenestration air leakage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swinging door air leakage</td>
</tr>
</tbody>
</table>
## Insulation Inspection

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Code Value</th>
<th>Verified Value</th>
<th>Complies</th>
<th>Comments/Notes/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1 [402.1.1, 402.2.5, 402.2.4, 303.2]</td>
<td>Wall insulation R-value. Installed per manufacturer’s instructions.</td>
<td>R-13 (wood) R-8 (mass) R-13 (cavity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN2 [402.1.1]</td>
<td>Basement wall interior insulation R-value. Installed per manufacturer’s instructions.</td>
<td>R-5 (cont) R-13 (cavity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN3 [402.2.7]</td>
<td>Basement wall interior insulation depth</td>
<td>10 ft or to basement floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN4 [402.2.11]</td>
<td>Sunroom wall insulation. Installed per manufacturer’s Instructions.</td>
<td>R-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN5 [402.4.1, 402.4.2]</td>
<td>Air sealing complies with sealing requirements or tested</td>
<td>Visual or ACH 50 &lt;= 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN6 [303.1]</td>
<td>All installed insulation labeled or installed R-value provided</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IN1 [402.1.1 402.2.5 402.2.4, 303.2]¹

Wall insulation R-value. Installed per manufacturer’s instructions.
IN2
[402.1.1]¹  Basement wall interior insulation R-value. Installed per manufacturer’s Instructions.
Basement Wall Insulation Depth

IN3 [402.2.7]^1

| Basement wall interior insulation depth |

## Air Sealing

### Air Sealing (Blower Door Test)

### Check List

<table>
<thead>
<tr>
<th>IN5</th>
<th>Air sealing complies with sealing requirements or tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>[402.4.1, 402.4.2]¹</td>
<td></td>
</tr>
</tbody>
</table>

---

Air Sealing Checklist

Blower Door Testing

Visual Inspection

IN5
[402.4.1, 402.4.2]

Air sealing complies with sealing requirements or tested
IN6
[303.1]²

All installed insulation labeled or installed R-value provided
## Final Inspection

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Final Inspection Provisions</th>
<th>Cod Value</th>
<th>Verified Value</th>
<th>Complied</th>
<th>Comments/Notes/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>F11 [402.1.1 402.2.1 402.2.2, 303.1.1.1, 303.2]</td>
<td>Ceiling insulation R-value. Installed per manufacturer’s instructions. Blown insulation marked every 300 ft².</td>
<td>R-30</td>
<td>R-____</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F12 [402.2.3]</td>
<td>Attic access hatch and door insulation</td>
<td>R-30</td>
<td>R-____</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F13 [402.2.11]</td>
<td>Sunroom ceiling insulation. Installed per manufacturer’s instructions</td>
<td>R-19</td>
<td>R-____</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F14 [402.1.1, 402.3.4]</td>
<td>Door U-factor</td>
<td>U-0.5¹⁰</td>
<td>U-____</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F15 [403.2.6]</td>
<td>Heating and cooling equipment type, make and model as per plans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F16 [404.1]</td>
<td>Lighting - 50% of lamps are high efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F17 [403.1.1]²</td>
<td>Programmable thermostats installed on forced air furnaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F18 [403.3]³</td>
<td>Heat pump thermostat installed on heat pumps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ceiling Insulation and Installation

FI1 [402.1.1 402.2.1 402.2.2, 303.1.1.1,303.2]¹

Ceiling insulation R-value. Installed per manufacturer’s instructions. Blown insulation marked every 300 ft².
Attic Access Hatch and Door Insulation

FI2
[402.2.3]\(^1\)  Attic access hatch and door insulation

Sunroom Ceiling Insulation

Sunroom ceiling insulation. Installed per manufacturer’s instructions

<table>
<thead>
<tr>
<th>FI4</th>
<th>Door U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>[402.1.1, 402.3.4]¹</td>
<td></td>
</tr>
</tbody>
</table>

# Heating Equipment

Verify make and model against information on the plans

<table>
<thead>
<tr>
<th>FI5 [403.2.6]$^1$</th>
<th>Heating and cooling equipment type, make and model as per plans</th>
</tr>
</thead>
</table>

Lighting

Lighting - 50% of lamps are high efficacy

FI6 [404.1]¹

# Programmable Thermostat

Programmable thermostats installed on forced air furnaces

<table>
<thead>
<tr>
<th>FI7</th>
<th>Programmable thermostats installed on forced air furnaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>[403.1.1]$^2$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FI8</th>
<th>Heat pump thermostat installed on heat pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>[403.3]$^2$</td>
<td></td>
</tr>
</tbody>
</table>

*Residential Evaluator Training. Building Energy Codes University. (2010)*
| FI9 [402.4.3]$^2$ | Fireplace - Gasketed doors and outdoor air for combustion |
Circulating service hot water systems have automatic or accessible controls
Checklist Consolidation and Scoring

• BECP will provide an online database and web form

• BECP will provide services to states for converting paper checklists to the electronic format.
Compliance Discussion Session

Topics for Discussion:

- Current state of energy codes
- Feasibility
- Cost of code compliance
- Enforcement
- Record-keeping
- Barriers to code compliance
- Technical assistance
PNNL Survey:

- Better understand compliance rates
- Jurisdictional practices
- Identify training needs
- Attempt to coordinate best practices with measured compliance rates
- Confidential results

REScheck Compliance Software
Training Module

School of Planning, Design & Construction
Michigan State University
East Lansing, Michigan
Demonstrate Compliance

- Prescriptive Packages Approach
- Trade-off Approach
- Performance Approach
REScheck Introduction

• Based on UA tradeoff

• REScheck Software Options
  – Web-based Version
    • Automatically updates
    • Save files online or download
  – Desktop Version
    • No internet connection required
    • Must check for updates
  – Rescheck package generator
    • Design your own code-compliant insulation and window packages based on regional requirements
    • No longer available after January 2011

REScheck Basics

Before Using REScheck, You Will Need:

• Basic understanding of Windows-based programs

• Basic information about the builder and house to be constructed

• House plans including:
  - Areas of exterior walls, glazing, roof/ceiling, basement walls, doors, crawl walls and floors
  - R-values, U-values, wall heights and insulation depths
  - Heating and cooling system efficiencies*

*Not included when choosing IECC 2009

Case Study House

Project Information:

• East Lansing, Michigan
• One story single family house
• Walkout basement
• Crawl space under portion
• Variable ceiling heights

Building Envelope

Conditioned Main Floor

Building Section

Conditioned Basement

Ceiling Area

Ceiling Area
2415 s.f.

Standard vs. Raised Heel or Energy Truss

**Exterior Wall Areas**

12' Exterior Walls - **689 s.f.**
- North – 221 s.f.
- South – 234 s.f.
- East – 52 s.f.
- West – 182 s.f.

9' Exterior Walls - **2180 s.f.**
- North – 690 s.f.
- South – 600 s.f.
- East – 440 s.f.
- West – 450 s.f.

3' knee walls (between 9'&12' sections) – **153 s.f.**
- West – 69 s.f.
- East – 84 s.f.

Including Rim Joists in the Exterior Wall Area

Baseline Walls

− below grade

>50% below grade =
below grade concrete basement wall

Basement Wall Areas

Above Grade Bsmt Walls (exterior wood) = 837 s.f. (93’ x 9’)
(entered as wood frame wall not a basement wall)

Below Grade Bsmt Walls = 1044 s.f.

Side basement walls = 360 s.f.
- West Wall – 144 s.f.
- East Wall – 216 s.f.

Back basement wall = 684 s.f. (76’x9’)
(solid concrete or masonry)

Basement Walls -  
- REScheck inputs

Floor Area

Crawlspace Area - 783 s.f.

Slab Perimeter

Slab Perimeter - 93 linear feet

Line represents the slab edge to be calculated in linear feet.

Perimeter Slab Insulation

Figure 2
- flashing
- protection board
- rigid insulation
- slab

Figure 3
- rigid insulation
- slab

Figure 4
- rigid insulation
- slab

Insulation Levels

Roof/Ceiling - R-38 batts
Wall - R-19 batts
Floor - R-19 batts
Slab - R-5 rigid (24” vertical)
Window/ Door Area

Window Area - 533 s.f.;
U-value = 0.40 & SHGC .40
North – 369 s.f.
South – 149 s.f.
West – 15 s.f.

Glass Doors <50% glass - 40 s.f.; U-value = 0.50
North – 40 s.f.
Opaque Doors - 40 s.f.; U-value = 0.50
South – 40 s.f.

Overhang/Projection Factor (PF)

\[ PF = \frac{A}{B} \]

\[ PF = 0.15 \]

REScheck Web or Desktop Download
Software & Tools

The Building Energy Codes Program offers two main compliance assessment software—REScheck for residential compliance assessment, and COMcheck for commercial compliance assessment—in both downloadable and web-based tools. BECP also offers both pre-defined prescriptive packages—which allow you to select from various combinations of energy conservation measures, based on your climate zone location—and a web-based prescriptive package generator which allows you to generate your own code-compliant insulation and window packages based on building location, window-to-wall ratio, and your choice of insulation levels. Along with the pre-defined prescriptive packages and generator, BECP has developed a set of prescriptive package field guides for the 1998/2000 IECC.

The latest Windows version of REScheck is Version 4.3.1 (released March 2010).

- See What's New in REScheck
- REScheck Prescriptive Package Generator
- Residential Online Training/Edution
- States that can use REScheck for Compliance
- Known problems in REScheck
- REScheck Product Archive
- 2009 IECC Residential Prescriptive Requirements

Get REScheck for your desktop

No time to download? Use REScheck-Web!

http://www.energycodes.gov/software.stm   Date visited: 11/22/2010
Software & Tools

The Building Energy Codes Program offers two main compliance assessment software—REScheck for residential compliance assessment, and COMcheck for commercial compliance assessment—in both downloadable and web-based tools. BECP also offers both pre-defined prescriptive packages—which allow you to select from various combinations of energy conservation measures, based on your climate zone location—and a web-based prescriptive package generator which allows you to generate your own code-compliant insulation and window packages based on building location, window-to-wall ratio, and your choice of insulation levels. Along with the pre-defined prescriptive packages and generator, BECP has developed a set of prescriptive package field guides for the 1990/2000 IECC.

http://www.energycodes.gov/software.stm

Date visited: 11/22/2010
Start the REScheck Web software here:

http://www.energycodes.gov/rescheck/

Date visited: 11/22/2010
REScheck Web has been updated!
Learn what's new. (October 2009)

REScheck Web is the web-based version of the REScheck desktop software. It performs just like the desktop version, but you don't need to download or install any software on your computer.

The REScheck Web application launches in a separate browser window. The browser toolbar is not available; instead, navigate using the interface provided by the application.

If REScheck Web is inactive for an hour or more you will lose your connection and any unsaved data will be lost. Please remember to save your work before leaving REScheck Web for extended periods of time.

Contact: Technical Support
Security & Privacy

Enter Project Information

3 Main Tabs: Project, Envelope, Mechanical

Enter Project Information

Click to Check Compliance
Enter Project Details

Click to Edit Project Name, Site Information, and Permit Number
REScheck Case Study Home

Update Project Details

Enter the title, location of this building, and permit number/date (if available). This information will appear on your compliance report.

Title: REScheck Case Study Home

Address: 101 Human Ecology Building Michigan State University

City: East Lansing  State: Michigan  Zip Code: 48823

Permit:

Permit #: 5655-56555  Permit Dates: 11/23/2010

Update Project Details  or  Cancel
REScheck Help Feature

REScheck-Web - Mozilla Firefox

Code/Location
Select the applicable code and the building location (view the current status of state energy codes).
- Code: 2009 IECC
- State: Michigan
- City: East Lansing
- County: Ingham

Project Details (optional)
This information will appear on the compliance report.
REScheck Case Study Home
101 Human Ecology Building Michigan State University
East Lansing, Michigan 48823
Permit #: 5555-55555
Permit Date: 11/23/2010

Notes:

REScheck HELP Feature

CHECK COMPLIANCE
To display compliance results, click the Check Compliance button.
REScheck Help Feature

The REScheck-Web Help System is here to assist you in using the REScheck-Web application. Whenever you see a "Help" icon you can click the link to load helpful information on the related topic.

This Help System has three major categories:

FAQ - Frequently Asked Questions are your shortcut to quick help. New categories are posted on here on the front page.

User's Guide - This guide provides a step-by-step look at the REScheck-Web application, explaining the various features and the user interface.

Glossary - The glossary defines many of the terms used throughout REScheck-Web and the REScheck-Web Help System.

Choose from Frequently Asked Questions (FAQ), the REScheck User's Guide, or a Glossary of Key Terminology.
Click the ENVELOPE Tab
Choose Building Components by Type and Enter Gross Area and Insulation Values for Each
Enter Envelope Components

Click 'Ceiling'
Enter Envelope Components

Choose ‘Raised or Energy Truss’

Click ‘Create Wall’
Raised Heel or Energy Truss

To receive credit for a raised heel truss (often referred to as an energy truss) the insulation must achieve its full thickness over the exterior walls. Scissor trusses meeting this criteria may also be entered as a raised truss.
Enter Envelope Components

Enter Gross Ceiling Area and Insulation Value(s)
Enter Envelope Components

Click ‘Wall’
Enter Envelope Components

Choose ‘Wood Frame, 16” o.c.’

Click ‘Create Wall’
Enter Envelope Components

**Click to Name Wall ‘Exterior Wall 1’**

**Enter Gross Area and Insulation Value(s)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Assembly</th>
<th>Gross Area</th>
<th>Cavity Insulation R-Value</th>
<th>Continuous Insulation R-Value</th>
<th>U-Factor</th>
<th>SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ceiling</td>
<td>Raised or Energy Truss</td>
<td>2415 ft²</td>
<td>38.0</td>
<td>0.0</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>2 Exterior Wall 1</td>
<td>Wood Frame, 10 in. d.c.</td>
<td>911 ft²</td>
<td>10.0</td>
<td>0.0</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>
Enter Envelope Components

<table>
<thead>
<tr>
<th>Row</th>
<th>Component</th>
<th>Assembly</th>
<th>Gross Area</th>
<th>Cavity Insulation R-Value</th>
<th>Continuous Insulation R-Value</th>
<th>U Factor</th>
<th>SHGC</th>
<th>Wall Height (ft)</th>
<th>Depth Below Grade (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ceiling</td>
<td>Raised or Energy Trues</td>
<td>2415 ft²</td>
<td>3.0</td>
<td>0.0</td>
<td>0.025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exterior Wall 1</td>
<td>Wood Frame, 16in. o.c.</td>
<td>911 ft²</td>
<td>19.0</td>
<td>0.0</td>
<td>0.050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Door 1</td>
<td>Solid</td>
<td>40 ft²</td>
<td></td>
<td></td>
<td>0.500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Window Main</td>
<td>Vinyl Frame, Double Pane</td>
<td>350 ft²</td>
<td></td>
<td></td>
<td>0.350</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ext. Wall 2 South</td>
<td>Wood Frame, 16in. o.c.</td>
<td>149 ft²</td>
<td></td>
<td></td>
<td>0.350</td>
<td>0.15</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>Window 2</td>
<td>Vinyl Frame, Double Pane</td>
<td>40 ft²</td>
<td></td>
<td></td>
<td>0.500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Door 2</td>
<td>Solid</td>
<td>492 ft²</td>
<td></td>
<td></td>
<td>0.050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ext. Wall 3 East</td>
<td>Wood Frame, 16in. o.c.</td>
<td>630 ft²</td>
<td></td>
<td></td>
<td>0.050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ext. Wall 4 West</td>
<td>Wood Frame, 16in. o.c.</td>
<td>15 ft²</td>
<td></td>
<td></td>
<td>0.350</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Window 3</td>
<td>Vinyl Frame, Double Pane</td>
<td>69 ft²</td>
<td></td>
<td></td>
<td>0.050</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Knee Wall West</td>
<td>Wood Frame, 16in. o.c.</td>
<td>84 ft²</td>
<td></td>
<td></td>
<td>0.050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Knee Wall East</td>
<td>Wood Frame, 16in. o.c.</td>
<td>216 ft²</td>
<td></td>
<td></td>
<td>0.047</td>
<td></td>
<td>9.0</td>
<td>7.0</td>
</tr>
<tr>
<td>13</td>
<td>Basement Wall 1</td>
<td>Solid Concrete or Masonry</td>
<td>144 ft²</td>
<td></td>
<td></td>
<td>0.047</td>
<td></td>
<td>9.0</td>
<td>7.0</td>
</tr>
<tr>
<td>14</td>
<td>Basement Wall 2</td>
<td>Solid Concrete or Masonry</td>
<td>684 ft²</td>
<td></td>
<td></td>
<td>0.047</td>
<td></td>
<td>9.0</td>
<td>7.0</td>
</tr>
<tr>
<td>15</td>
<td>Basement Wall 3</td>
<td>Solid Concrete or Masonry</td>
<td>844 ft²</td>
<td></td>
<td></td>
<td>0.047</td>
<td></td>
<td>9.0</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Enter Remaining Components

To display compliance results, click the Check Compliance button.
Enter Envelope Components

Some Component Dimensions May Be Entered Graphically
Compliance with the 2009 IECC can be demonstrated using the *Total UA ('Trade-Off') Alternative* or the *Performance Alternative*.

The UA Alternative does not consider mechanical systems so mechanical inputs are not available. Under the Performance Alternative, mechanical systems can be specified and may impact the results, however no trade-off credits for high efficiency mechanical equipment are allowed.
Compliance Check

When Finished, Click ‘Check Compliance’
Compliance Check

Building Passes or Fails Based if the Maximum Allowed UA is Not Exceeded By Your (Designed) UA Value (577.0 Designed of Max. 582.0)
Manage Project Files

Save Your Work!

Change User Preferences or Manage Project Files

Load or Delete Previous Projects, or Export Projects for Use With REScheck Desktop Software
Creating Compliance Reports

Click ‘Reports’
Your compliance report (121.9 KB) is ready.

Click the link to view the report, or right-click it and select "Save Target As" to save the report on your computer.

An RTF version of the report (102.6 KB) may also be viewed or saved.

You may also e-mail the PDF version of the compliance report to your local code official using the REScheck-Web. Simply complete the following form and click the "Send Report" button below. Fields marked with a red asterisk (*) are required.

Send Report To

* Permitting Facility: 

* Facility E-mail Address: 

Address(es) for CC: 

Additional Notes: 

From

* Your Name: 

Your Company: 

* Your E-mail Address: remylee@msu.edu 

» Send Report
Your compliance report (121.9 KB) is ready.

Click the link to view the report, or right-click it and select "Save Target As" to save the report on your computer. An RTF version of the report (102.6 KB) may also be viewed or saved.

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---

**Send Report To**

- Permitting Facility: Facility Name
- Facility Email Address: email@facility.com
- Address(es) for CC: (Other Team Members)

**From**

- Your Name: Sparty
- Your Company: 
- Your Email Address: remylee@msu.edu

Additional Notes: Enter additional notes or project communications here.

---

Complete Information to Email Compliance Reports
**Compliance Report**

Generated by REScheck-Web Software

**Compliance Certificate**

- **Energy Code:** 2009 IECC
- **Location:** East Lansing, Michigan
- **Construction Type:** Single Family
- **Glazing Area Percentage:** 18%
- **Heating Degree Days:** 7228
- **Climate Zone:** 5

**Construction Site:**
- **Owner/Agent:**
- **Designer/Contractor:**

**Compliance: Passes using UA trade-off**

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area or Perimeter</th>
<th>Cavity R-Value</th>
<th>Cont. R-Value</th>
<th>Glazing or Door U-Factor</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling: Raised or Energy Truss</td>
<td>2415</td>
<td>38.0</td>
<td>0.0</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Exterior Wall 1: Wood Frame, 16in. o.c.</td>
<td>911</td>
<td>19.0</td>
<td>0.0</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Door 1: Solid</td>
<td>40</td>
<td>19.0</td>
<td>0.0</td>
<td>0.500</td>
<td>20</td>
</tr>
<tr>
<td>Window Main: Vinyl Frame, Double Pane</td>
<td>369</td>
<td>19.0</td>
<td>0.0</td>
<td>0.350</td>
<td>129</td>
</tr>
<tr>
<td>Ext. Wall 2 South: Wood Frame, 16in. o.c.</td>
<td>834</td>
<td>19.0</td>
<td>0.0</td>
<td>0.350</td>
<td>39</td>
</tr>
<tr>
<td>Window 2: Vinyl Frame, Double Pane</td>
<td>149</td>
<td>19.0</td>
<td>0.0</td>
<td>0.350</td>
<td>52</td>
</tr>
</tbody>
</table>

- **Project Information and Passing Score Displayed**
- **Inventory of Building Components**
Generated by REScheck-Web Software

Inspection Checklist

Ceilings:
- Ceiling: Raised or Energy Truss, R-38.0 cavity insulation
  Comments: ____________
  Insulation must achieve full height over the plate lines of exterior walls.

Above-Grade Walls:
- Exterior Wall 1: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________
- Ext. Wall 2 South: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________
- Ext. Wall 3 East: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________
- Ext. Wall 4 West: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________
- Knee Wall West: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________
- Knee Wall East: Wood Frame, 16in. o.c., R-19.0 cavity insulation
  Comments: ____________

Checklist Allows Code Official to Verify Individual Building Components
# 2009 IECC Energy Efficiency Certificate

<table>
<thead>
<tr>
<th>Insulation Rating</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling / Roof</td>
<td>38.00</td>
</tr>
<tr>
<td>Wall</td>
<td>19.00</td>
</tr>
<tr>
<td>Floor / Foundation</td>
<td>30.00</td>
</tr>
<tr>
<td>Ductwork (unconditioned spaces)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Glass &amp; Door Rating</th>
<th>U-Factor</th>
<th>SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window</td>
<td>0.35</td>
<td>0.15</td>
</tr>
<tr>
<td>Door</td>
<td>0.50</td>
<td>NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heating &amp; Cooling Equipment</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating System</td>
<td></td>
</tr>
<tr>
<td>Cooling System</td>
<td></td>
</tr>
<tr>
<td>Water Heater</td>
<td></td>
</tr>
</tbody>
</table>

Name: ___________________________ Date: ____________

Comments: Bob White

Certificate posted

Certificate Posted at Electrical Panel to Identify Primary Building Components

Name of Building Inspector and Date of Final Inspection

Additions and Renovations

• In REScheck, model additions and renovations as a separate building (new project)

• The REScheck software tools cannot currently be used to show compliance using the prescriptive criteria alternative compliance defined for sunrooms and additions in the 2003 IECC. Compliance can be shown by including requirements for the applicable minimum component insulation and maximum U-factor for fenestration on the building plans.

• Attaching the applicable table to your building plans and highlighting the applicable criteria will help expedite approval.
Sunroom Additions

Thermal Barrier

Sunroom Requirements

- Sunrooms must meet the following criteria to use the sunroom compliance path:
  - An area <500 square feet
  - >40% glazing of gross exterior wall and roof area
  - thermally isolated
  - not used as a kitchen or sleeping quarters
  - separate heating/cooling system or zone

Ceiling Insulation
- Zones 1-4 R-19
- Zones 5-8 R-24

Wall Insulation
- All zones R-13

Fenestration U-Factor
- Zones 4-8 0.50

Skylight U-Factor
- Zones 4-8 0.75
Sunroom Addition

- Ceiling – 350 s.f.
- East Wall – 18 s.f.
- West Wall – 252 s.f.
- West Windows – 144 s.f
  (U-value .35/SHGC .40)
- North Wall – 112 s.f.
- North Windows – 63 s.f.
  (U-value .35/SHGC .40)
- South Wall – 126 s.f.
- South Windows – 51 s.f.
  (U-value .35/SHGC .40)
- Floor – 350 s.f.

Plan review for energy code compliance can be conducted quickly and efficiently. The U.S. Department of Energy’s REScheck™ Compliance Software is designed to create simplified compliance certificates that can be easily reviewed by enforcement personnel. The Quick Reference Guide identifies the objectives of plan review and code compliance responsibilities, and will take you step-by-step through a typical plan review of a REScheck™ submittal.

Plan Review Objectives: There are three objectives in conducting a building energy code plan review; verify:

A. the documentation has been correctly prepared
B. the levels of efficiency shown on the plans meet or exceed that shown in the documentation
C. all information needed to conduct a field inspection is included in the plans or documentation for the inspector to use on site
Residential Plan Review

Code Compliance Responsibilities: Successful compliance requires the cooperation of many individuals involved in a building project: designers, engineers, architects, builders, building owners, and others. Compliance also requires the efforts of certain individuals to whom the code gives specific responsibilities:

- Applicant
- Building official
- Plans examiner or special plans examiner
- Inspector or special inspector.

Role of the Applicant: The applicant is the person named on the building permit. The applicant is ultimately responsible for meeting all requirements specific in the code. The applicant may be the owner, architect, engineer, contractor or any other authorized agent for the project owner who applies for the building permit.

Role of the Building Official: The building official is typically responsible for enforcing all provisions of the code. To carry out code enforcement, the building official may appoint technical officers and inspectors.

Role of the Plans Examiner or Special Plans Examiner: Plans examiners or special plans examiners are typically responsible for verifying the plans for energy code compliance.

Role of the Inspector or Special Inspector: Inspectors and special Inspectors are responsible for conducting field inspections for energy code compliance.
Residential Plan Review

REScheck™ Software Version 4.3.1
COMPLIANCE CERTIFICATE

Project Title: Jones Residence - Plan 3677
Energy Code: 2009 IECC
Location: Bloomingdale, Illinois
Construction Type: Single Family
Building Orientation: Bldg. faces 180 deg. from North
Glazing Area Percentage: 18%
Heating Degree Days: 6536
Climate Zone: 5

Construction Site: Permit Date: March 15, 2010
Owner/Agent: JJ Jones
Designer/Contractor: Done Right Construction

Step1: Verify the Project Information matches the building plans. The Energy Code, Location, and Construction Type will impact energy code compliance.
### Step 2: Verify Compliance (UA Trade-Off or Performance Alternative)

Verify the building thermal envelope assemblies and Gross Area or Perimeter values are consistent with building plans. Verify the fenestration is calculated using the rough opening as shown on the plans. Walls that separate conditioned from unconditioned spaces such as a garage should be included in the wall area.

### Step 3: Verify the building thermal envelope assemblies and Gross Area or Perimeter values are consistent with building plans.

Verify the fenestration is calculated using the rough opening as shown on the plans. Walls that separate conditioned from unconditioned spaces such as a garage should be included in the wall area.

### Step 4: Verify the insulation R-values shown on the building plans match or exceed the values in the Cavity R-value and Continuous R-value columns. Values should be for insulation only. Verify the insulation will fit uncompressed in the framing cavity. Continuous R-values should be for insulation installed over the face of framing or insulation installed with no thermal breaks.

### Compliance: Passes using UA trade-off

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area or Perimeter</th>
<th>Cavity R-Value</th>
<th>Cont. R-Value</th>
<th>Glazing or Door U-Factor</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling 1: All-Wood Joist/Rafter/Truss</td>
<td>2415</td>
<td>49.0</td>
<td>0.0</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Exterior Wall 1: Wood Frame, 16” o.c.</td>
<td>911</td>
<td>20.0</td>
<td>0.0</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Orientation: Front</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door 1: Opaque</td>
<td>40</td>
<td>0.500</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation: Front</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window main: Vinyl Frame, Double Pane</td>
<td>369</td>
<td>0.350</td>
<td>129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHGC: 0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation: Front</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior Wall 2 South: Wood Frame, 16” o.c.</td>
<td>834</td>
<td>20.0</td>
<td>0.0</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Orientation: Back</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Assembly

<table>
<thead>
<tr>
<th>Window 2: Vinyl Frame: Double Pane with Low-E</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHGC: 0.40</td>
</tr>
<tr>
<td>Orientation: Back</td>
</tr>
<tr>
<td>Gross Area or Perimeter: 149</td>
</tr>
<tr>
<td>Cavity R-Value: 0.350</td>
</tr>
<tr>
<td>Cont. R-Value: 52</td>
</tr>
<tr>
<td>Glazing or Door U-Factor: 0.500</td>
</tr>
<tr>
<td>UA: 20</td>
</tr>
</tbody>
</table>

| Door 2: Solid                               |
| Orientation: Back                          |
| Gross Area or Perimeter: 40                |
| Cavity R-Value: 20.0                       |
| Cont. R-Value: 0.0                         |
| Glazing or Door U-Factor: 0.500            |
| UA: 29                                      |

| Exterior Wall 3 East: Wood Frame, 16” o.c. |
| Orientation: Left Side                    |
| Gross Area or Perimeter: 492              |
| Cavity R-Value: 20.0                       |
| Cont. R-Value: 0.0                         |
| Glazing or Door U-Factor: 0.500            |
| UA: 29                                      |

| Exterior Wall 4 West: Wood Frame, 16” o.c. |
| Orientation: Right Side                    |
| Gross Area or Perimeter: 632               |
| Cavity R-Value: 20.0                       |
| Cont. R-Value: 0.0                         |
| Glazing or Door U-Factor: 0.500            |
| UA: 36                                      |

<table>
<thead>
<tr>
<th>Window 3: Vinyl Frame:Double Pane with Low-E</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHGC: 0.40</td>
</tr>
<tr>
<td>Orientation: Right Side</td>
</tr>
<tr>
<td>Gross Area or Perimeter: 15</td>
</tr>
<tr>
<td>Cavity R-Value: 0.350</td>
</tr>
<tr>
<td>Cont. R-Value: 5</td>
</tr>
<tr>
<td>Glazing or Door U-Factor: 0.350</td>
</tr>
<tr>
<td>UA: 5</td>
</tr>
</tbody>
</table>

| Knee Wall West: Wood Frame, 16” o.c.       |
| Orientation: Left Side                     |
| Gross Area or Perimeter: 69                |
| Cavity R-Value: 20.0                       |
| Cont. R-Value: 0.0                         |
| Glazing or Door U-Factor: 0.500            |
| UA: 4                                       |

| Knee Wall East: Wood Frame, 16” o.c.       |
| Orientation: Right Side                     |
| Gross Area or Perimeter: 84                 |
| Cavity R-Value: 20.0                       |
| Cont. R-Value: 0.0                         |
| Glazing or Door U-Factor: 0.500            |
| UA: 5                                      |

---

**Step 5:** Verify Orientation of each wall component and fenestration matches the building plans. Orientation is optional if showing compliance based on UA Trade Off.

**Step 6:** Verify the fenestration U-Factors and SHGCs match what is specified on building plans.

---

**WARNING:** “Other” Assembly(s) display only a U-Factor with no insulation values. Back-up documentation should be requested, if not provided, on the specifications for the overall U-Factor shown. _No “other” assemblies are listed in this project._
<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area or Perimeter</th>
<th>Cavity R-Value</th>
<th>Cont. R-Value</th>
<th>Glazing or Door U-Factor</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement Wall 2: Solid Concrete or Masonry</td>
<td>144</td>
<td>20.0</td>
<td>0.0</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Orientation: Left Side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall height: 9.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth below grade: 4.5'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation depth: 9.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement Wall 1: Solid Concrete or Masonry</td>
<td>216</td>
<td>20.0</td>
<td>0.0</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Orientation: Right Side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall height: 9.0'</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth below grade: 4.5'</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation depth: 9.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement Wall 3: Solid Concrete or Masonry</td>
<td>684</td>
<td>20.0</td>
<td>0.0</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Orientation: Front</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall height: 9.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth below grade: 7.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation depth: 9.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor 1: All-Wood Joist/Truss, Over Unconditioned Space</td>
<td>783</td>
<td>20.0</td>
<td>0.0</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Floor 2: Slab-On-Grade: Unheated</td>
<td>93</td>
<td>10.0</td>
<td>0.0</td>
<td></td>
<td>64</td>
</tr>
</tbody>
</table>

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2009 IECC requirements in REScheck Version 4.3.1 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

Step 7: Verify the correct floor assembly(s) that define the building thermal envelope are shown. For example, a crawl space vented to the outside, the crawl walls would not be part of the building thermal envelope and should not be shown on the report, but the floor above the vented crawl space should be shown as part of the building thermal envelope. If a conditioned basement is fully below grade with a foundation that is > 12" below grade, a slab on grade assembly should not be shown on the report. If it is a walkout basement, slab on grade should be shown in linear feet of the slab on grade area that is exposed.

Step 8: Verify the dimensions of below grade walls (basement walls) and the specified insulation values. Continuous insulation R-values specified for basement walls would be considered insulation installed on the exterior side of the wall component.

Step 9: Verify the Compliance Statement has been signed. If the signature line does not appear, this means the building is not in compliance as entered.
REScheck™ Software Version 4.3.1
INSPECTION CHECKLIST

Ceilings:
- Ceiling 1: All-Wood Joist/Rafter/Truss, R-49.0 cavity insulation
  Comments:

Above-Grade Walls:
- Exterior Wall 1: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:
- Exterior Wall 2 South: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:
- Exterior Wall 3 East: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:
- Exterior Wall 4 West: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:
- Knee Wall West: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:
- Knee Wall East: Wood Frame, 16" o.c., R-20.0 cavity insulation
  Comments:

Basement Walls:
- Basement Wall 2: Solid Concrete or Masonry, 9.0' ht / 4.5' bg / 9.0' insul, R-20.0 cavity insulation
  Comments:
- Basement Wall 1: Solid Concrete or Masonry, 9.0' ht / 4.5' bg / 9.0' insul, R-20.0 cavity insulation
  Comments:
- Basement Wall 3: Solid Concrete or Masonry, 9.0' ht / 7.0' bg / 9.0' insul, R-20.0 cavity insulation
  Comments:

Windows:
- Window main: Vinyl Frame, Double Pane, U-factor: 0.350
  For windows without labeled U-factors, describe features:
  #Panes _____ Frame Type ______, Thermal Break? Yes _____ No _____
  Comments:
- Window 2: Vinyl Frame:Double Pane with Low-E, U-factor: 0.350
  For windows without labeled U-factors, describe features:
  #Panes _____ Frame Type ______, Thermal Break? Yes _____ No _____
  Comments:
- Window 3: Vinyl Frame:Double Pane with Low-E, U-factor: 0.350
  For windows without labeled U-factors, describe features:
  #Panes _____ Frame Type ______, Thermal Break? Yes _____ No _____
  Comments:

Doors:
- Door 1: Opaque, U-factor: 0.500
  Comments:
  This door is exempt from the U-factor requirement.
- Door 2: Solid, U-factor: 0.500
  Comments:

Floors:
- Floor 1: All-Wood Joist/Truss, Over Unconditioned Space, R-30.0 cavity insulation
  Comments:

Step 10: Verify the R-values, U-factors, and SHGCs of all building thermal envelope components listed on the Inspection Checklist match the values listed in the preceding section. Include any comments to the inspectors in this section. Check the comments on each of the sections to ensure that they apply to the project.
Air Leakage:

- Joints (including rim joist junctions), attic access openings, penetrations, and all other such openings in the building envelope that are sources of air leakage are sealed with caulk, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.
- Air barrier and sealing exists on common walls between dwelling units, on exterior walls behind tubs/showers, and in openings between window/door jambs and framing.
- Recessed lights in the building thermal envelope are 1) type IC rated and ASTM E283 labeled and 2) sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.
- Access doors separating conditioned from unconditioned space are weather-stripped and insulated (without insulation compression or damage) to at least the level of insulation on the surrounding surfaces. Where loose fill insulation exists, a baffle or retainer is installed to maintain insulation application.
- Wood-burning fireplaces have gasketed doors and outdoor combustion air.

Air Sealing and Insulation:

- Building envelope air tightness and insulation installation complies by either 1) a post rough-in blower door test result of less than 7 ACH at 33.5 psf OR 2) the following items have been satisfied:
  - Air barriers and thermal barrier: Installed on outside of air-permeable insulation and breaks or joints in the air barrier are filled or repaired.
  - Ceiling/attic: Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed.
  - Above-grade walls: Insulation is installed in substantial contact and continuous alignment with the building envelope air barrier.
  - Floors: Air barrier is installed at any exposed edge of insulation.
  - Plumbing and wiring: Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
  - Corners, headers, narrow framing cavities, and rim joists are insulated.
  - Shower/tub on exterior wall: Insulation exists between showers/tubs and exterior wall.

Step 11: If Air Sealing and Insulation are not verified via testing, the items listed must be verified by Visual Inspection.
Duct Insulation:
- Supply ducts in attics are insulated to a minimum of R-8. All other ducts in unconditioned spaces or outside the building envelope are insulated to at least R-6.

Duct Construction and Testing:
- Building framing cavities are not used as supply ducts.
- All joints and seams of air ducts, air handlers, filter boxes, and building cavities used as return ducts are substantially airtight by means of tapes, mastics, liquid sealants, gasketing or other approved closure systems. Tapes, mastics, and fasteners are rated UL 181A or UL 181B and are labeled according to the duct construction. Metal duct connections with equipment and/or fittings are mechanically fastened. Crimp joints for round metal ducts have a contact lap of at least 1 1/2 inches and are fastened with a minimum of three equally spaced sheet-metal screws.

Exceptions:
- Joint and seams covered with spray polyurethane foam.
- Where a partially inaccessible duct connection exists, mechanical fasteners can be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.
- Continuously welded and locking-type longitudinal joints and seams on ducts operating at less than 2 in. w.g. (500 Pa).

Note: Duct tightness testing is a new requirement in the 2009 IECC. Duct tightness can be verified with a Postconstruction Test or a Rough-In Test.

- Duct tightness test has been performed and meets one of the following test criteria:
  - Postconstruction leakage to outdoors test: Less than or equal to 323.8 cfm (8 cfm per 100 ft² of conditioned floor area).
  - Postconstruction total leakage test (including air handler enclosure): Less than or equal to 485.6 cfm (12 cfm per 100 ft² of conditioned floor area) pressure differential of 0.1 inches w.g.
  - Rough-in total leakage test with air handler installed: Less than or equal to 242.8 cfm (6 cfm per 100 ft² of conditioned floor area) when tested at a pressure differential of 0.1 inches w.g.
  - Rough-in total leakage test without air handler installed: Less than or equal to 161.9 cfm (4 cfm per 100 ft² of conditioned floor area).
Heated swimming pools have a cover on or at the water surface. For pools heated over 90 degrees F (32 degrees C) the cover has a minimum insulation value of R-12.

Exceptions:
Covers are not required when 60% of the heating energy is from site-recovered energy or solar energy source.

Lighting Requirements:

- A minimum of 50 percent of the lamps in permanently installed lighting fixtures can be categorized as one of the following:
  - Compact fluorescent
  - T-8 or smaller diameter linear fluorescent
  - 40 lumens per watt for lamp wattage <= 15
  - 50 lumens per watt for lamp wattage > 15 and <= 40
  - 60 lumens per watt for lamp wattage > 40

Note: Lighting is a new requirement in the 2009 IECC.

Other Requirements:

- Snow- and ice-melting systems with energy supplied from the service to a building shall include automatic controls capable of shutting off the system when:
  a) the pavement temperature is above 50 degrees F,
  b) no precipitation is falling,
  c) the outdoor temperature is above 40 degrees F (a manual shutoff control is also permitted to satisfy requirement ‘c’).

Certificate:

- A permanent certificate is provided on or in the electrical distribution panel listing the predominant insulation R-values; window U-factors; type and efficiency of space-conditioning and water heating equipment. The certificate does not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels.

NOTES TO FIELD: (Building Department Use Only)
# 2009 IECC
## Energy Efficiency Certificate

<table>
<thead>
<tr>
<th>Insulation Rating</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling / Roof</td>
<td>49.00</td>
</tr>
<tr>
<td>Wall</td>
<td>20.00</td>
</tr>
<tr>
<td>Floor / Foundation</td>
<td>30.00</td>
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<tr>
<td>Ductwork (unconditioned spaces):</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Glass &amp; Door Rating</th>
<th>U-Factor</th>
<th>SHGC</th>
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</thead>
<tbody>
<tr>
<td>Window</td>
<td>0.35</td>
<td>0.40</td>
</tr>
<tr>
<td>Door</td>
<td>0.50</td>
<td>NA</td>
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<table>
<thead>
<tr>
<th>Heating &amp; Cooling Equipment</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating System:</td>
<td></td>
</tr>
<tr>
<td>Cooling System:</td>
<td></td>
</tr>
<tr>
<td>Water Heater:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments:</td>
<td></td>
</tr>
</tbody>
</table>

**Step 12:** Verify information matches compliance report. Additional information may need to be manually entered (water heater efficiency, duct insulation). The code requires that only the predominant values be listed. Where there is more than one value for each component the certificate should list the value covering the largest area.
COMcheck software also available for commercial projects:
http://www.energycodes.gov/comcheck/
Additional Information Resources

Training Module

Michigan State University
East Lansing, Michigan
DOE Homepage: www.energy.gov

- National Security
- Energy Sources
- Energy Efficiency
- Environment
- Energy Prices and Trends
- Science and Technology
- Health
- Safety and Security

- Program Offices
- Staff Offices
- Energy Information Administration
- National Laboratories and Technology Centers
- Operations Offices and Field Organizations

http://www.energy.gov Date visited: 3/14/2011
Building Energy Codes Program

BECP Homepage:
http://www.energycodes.gov/

- Free Code Downloads
- Residential (REScheck)
- Commercial (COMcheck)
- Compliance Tools
- Federal Building Codes
- Building Energy Codes University (BECU)
- Training Presentations
- State Training Events
- Consumer Education
- Energy Codes Glossary

Date visited: 3/14/2011
Welcome to the Building Energy Codes Resource Center

This system has been developed to provide users with information about energy codes and beyond code technologies. You can SEARCH by keyword, or BROWSE the available topics. Start your research using the toolbar at the top of the page.

Resources are available in a variety of different media types, including Articles, Graphics, Online Tools, Presentations, and Videos. The BECP Resource Center gathers content not only from our own archives, but also provides links to energy code resources from around the web. Learn more about the Resource Center.

Something missing? Send us your materials if you see something outdated, or let us know if you have requests for information we don't have.
Building Energy Codes University (BECU)

Training Hard to Save Energy
The Building Energy Codes University provides a one-stop shop for all of your building energy codes training needs — whether you are new to the world of energy codes or are a seasoned veteran.

Course Offerings
BECU offers training in a variety of formats and media types; from self-paced online training to live webcast events to tailored on-site training. Course topics cover the entire spectrum of building energy codes at all levels. Course topics include:

- Compliance with the American Recovery and Reinvestment Act
- The 2009 International Energy Conservation Code
- The ASHRAE 90.1-2007 standard
- REScheck and COMcheck basics
- and much more...

A Continuing Education Provider
BECU, through the Building Energy Codes Program, is a continuing education provider for the American Institute of Architects.

BECU Home: http://www.energycodes.gov/becu/

General Information
- Building Energy Codes 101 - An Introduction

Webcasts On-Demand
- Comply! Energy Code Tools You May Be Missing
- Duct Testing

Self-Paced Training
- Codes 101
- Area Takeoffs 101

Instructions
- Webcasts On-Demand
- Self-Paced Courses
Online Learning Modules:

http://www.energycodes.gov/becu/

REScheck Basics

Course Description:
This training covers the basics of using REScheck software and is geared toward the beginning user.

Original Webcast Date
February 19, 2009

Presented by:
Rosemarie Bartlett and Pam Cole
Pacific Northwest National Laboratory

Downloads:
Video (1 hour, 8 minutes)
Video Transcript
Presentation Slides
2012 International Codes
New Codes for a Changing World

Free 2009 IECC Download Instructions

The IECC Free Download offer has expired
However, ICC continues to look for ways to serve our members and customers with other great benefits through strategic alliances with the DOE and others. Thank you for visiting, and check ICC News and website often for new special offerings.

ASHRAE 90.1—2007 Download

ASHRAE


Through funding from the U.S. Department of Energy (DOE), the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) had offered the Standard 90.1-2007 Inch Pound Edition (I-P Edition) available to download at no-cost for a limited time.

Due to overwhelming popularity, no-cost copies of 90.1-2007 are no longer available.

ASHRAE is now offering the digital version of the Standard at a reduced price of $19.00 for a limited time.

Visit ASHRAE's website to purchase a copy of Standard 90.1-2007 at this reduced price now.

http://www.energycodes.gov/publications/code_books.stm

Date visited: 3/14/2011
REScheck and COMcheck
Welcome to the Building Codes Assistance Project (BCAP)

BCAP's home site is undergoing revisions!

While we're working on improving the site, please visit our energy code resource and community site, the Online Code Environment and Advocacy Network (OCEAN). Launched in November 2009, OCEAN offers users the chance to browse a comprehensive energy codes library, interact with a network of energy code stakeholders, catch the latest energy code news and events, and, of course, check out BCAP's various energy code status maps and other helpful tools.

You may notice that a page you are used to looking at is no longer available here. However, we have provided re-directs for all of our most popular pages that are now on OCEAN.

Visit OCEAN at www.bcap-ocean.org
BCAP: OCEAN

http://bcap-ocean.org/  Date visited: 3/14/2011
BCAP: OCEAN

http://bcap-ocean.org/code-status Date visited: 3/14/2011
BCAP: OCEAN

The Online Code Environment and Advocacy Network
Navigating the World of Energy Codes | www.bcap-ocean.org

Why Energy Codes Matter

What Consumers Need to Know

We don’t often think about how much energy used in buildings impacts society. Yet buildings account for over 40 percent of total energy use in the United States—more than either the transportation or industrial sectors.

Building energy codes matter because they:

Save Consumers Money

For most people, buying a home is the most expensive investment they will ever make. It is surprising, then, that so many of us don’t look at the operational costs of our homes when making a purchase. Most homes waste energy needlessly, and those costs add up. In 2009, US households spent about $2,223 on average for energy bills. Energy efficient buildings use less energy, which reduces utility bills and puts money back into consumers’ pockets. Millions of additional dollars are now available to...

Help Stimulate the Economy and Create Green Jobs

Consumers spend the money they save from reduced energy bills on other goods and services, which bolster the local economy. Businesses can transfer savings to other areas of need, such as production, investment, and employee retention, as well as provide more work for local inspection departments. Setting new standards for efficiency also creates a growing market for energy audits, retrofits, and weatherization. In short, investing in energy efficiency projects creates or sustains a wide-range of green jobs. Of course, at their most basic level, building codes are designed to...

Ensure Health and Safety

First, energy codes reduce heating and cooling costs, helping protect millions of low-income Americans who can now afford to stay warm in the winter and cool in the summer. Second, they reduce pollution from electricity generation and improves indoor air quality, both of which keep us healthier. Finally, they reduce greenhouse gas emissions, which mitigates the impacts of global climate change. Finally, energy codes ...

Provide Comfort

An important advantage of energy-efficient homes is that they receive a higher rate of homeowner satisfaction. Lower air infiltration rates, along with lower utility bills and higher potential resale values, lead to happy customers with comfortable homes. Energy efficient construction also cuts back the time and money that may be spent in the future on home improvement projects to make living spaces more comfortable.

OCEAN is an online resource of the Building Codes Assistance Project
For more information, please visit us at: www.bcap-ocean.org

Energy efficiency is in! But as demand for more stringent energy codes grows, so does the complexity of the codes process and the need for a broad coalition of stakeholders. For anyone new to codes, simply identifying the many actors involved can be a daunting task, much less finding opportunities for involvement. Even veteran code experts must stay up-to-date with the changing landscape.

To help make sense of it all, BCAP is proud to introduce the Energy Codes Universe!

Disclaimer: The intent of this resource is to include all participants in the energy codes process. However, BCAP acknowledges the possibility of excluding deserving organizations. All omissions are inadvertent. If you believe that your organization merits recognition in the Energy Codes Universe, please contact us at bcap-ocean@asme.org.
ASHRAE Standard 90.1 -- Energy Standard for Buildings Except Low-Rise Residential Buildings

Training and Resources

Professional Development Seminars (Full-Day)
Complying with Standard 90.1-2007
This course is targeted at design professionals, code officials and building owners. ASHRAE Standard 90.1-2007 includes significant changes from the previous versions, such as reducing the number of climate zones from 20 to 8, refining a number of HVAC provisions, improving stringency of lighting power requirements, and adding an appendix with more flexible rules when using 90.1 for LEED certification. This course presents an overview of the 2004 standard, the addenda that are added in the 2007 version, the standard’s requirements, and methods for compliance.

Exceeding the Requirements of Standard 90.1-2007
This course is targeted at design professionals and building owners. Appendix G, a new informative appendix in 90.1 since 2004, provides specific guidance on the rules and procedures to use to simulate building energy use when the objective is to substantially exceed the requirements of 90.1. Appendix G is especially useful for energy simulations connected with LEED credits and with energy tax credits. This course presents an overview of Appendix G and explains its use through a number of examples using eQUEST.

Short Courses (Half-Day)
Complying with Standard 90.1-2007: HVAC/Mechanical
This course presents the HVAC/mechanical and methods of compliance from ASHRAE Standard 90.1-2007. Standard 90.1 is the benchmark for commercial building energy codes in the United States and in countries around the world. States are currently in the process of adopting elements of the Standard. The U.S. Department of Energy is also reviewing it in preparation for adoption as the new benchmark for state energy codes. This course presents an overview of the Standard and excerpts changes to the 2004 mechanical section that are part of the 2007 Standard. Design professionals, code officials and building owners will benefit from this seminar.

Exceeding Standard 90.1-2007
This course explains Appendix G, a new informative appendix in 90.1 since 2004, provides specific guidance on the rules and procedures to use to simulate building energy used when the objective is to substantially exceed the requirements of 90.1. Appendix G is especially useful for energy simulations connected with LEED credits and with energy tax credit.
ICC Training Resources

Education, Certification & Testing

ICC's education and certification offerings are a valuable resource for construction-related professionals. Code officials, building inspectors, design professionals, and more, look to ICC to provide the critical skills and knowledge necessary to excel in today's challenging construction world. ICC's education programs cover a broad spectrum of code and construction-related topics. ICC can provide seminars nationwide and also has a growing online offering. ICC's certification and testing programs offer internationally recognized credentials as well as regional and specialty testing programs that validate knowledge and skills across a variety of professions, job roles, and disciplines.

Education

Whether you want to build your skills and knowledge, stay on the leading edge of code development, or prepare for your next certification exam, ICC's training programs are designed for maximum impact and results. Explore your training options below.

- Course Information
- Online University
- Webinars

Certification & Testing

ICC develops and administers certifications and testing programs for code and construction professionals at the national, state, and municipality levels. Explore your certification options below.

http://www.iccsafe.org/Edu-Cert/Pages/default.aspx  Date visited: 3/14/2011
Training Workshops

Energy Codes 2010
http://www.energycodes.gov/events/energycodes/agenda_presentations.stm

Energy Codes 2011
http://www.energycodes.gov/events/energycodes

BEST3 Conference 2012
http://www.thebestconference.org/program.php

Efficiency Vermont 2011 Conference Presentations
http://www.efficiencyvermont.com/for_our_partners/bbd/conference_schedule.aspx

Greenbuild International Conference and Expo
http://www.greenbuildexpo.org/Home.aspx
Upcoming Workshops

For a list of upcoming energy related conferences, workshops and events:

U.S. DOE: Energy Information Administration:
http://www.eia.doe.gov/calendar/meetings.htm
State of Michigan Resources

Michigan Bureau of Construction Codes (BCC):
http://www.michigan.gov/dleg/0,1607,7-154-10575---,00.html

http://www.michigan.gov/dleg/0,1607,7-154-25676---,00.html

Energy Efficiency for Small Businesses:

Energy Star Homes Brochure:

Home Maintenance and Operations:
Energy Star is a government-backed program helping businesses and individuals protect the environment through superior energy efficiency.

For more information: [http://www.energystar.gov/](http://www.energystar.gov/)
Video Resource: Weatherization TV

EPISODES

Training America's Wx Workforce

WxTV will take a look inside eight weatherization training centers around the country to see what they're doing to train the weatherization workforce. The technology and techniques in training have come a long way.

running length: 20:48 date added: 2/11/11

Attic Prep & Insulation

Insulating an attic is one of the cornerstones of weatherization. On a six degree day in Fargo, ND, Doug Bakke and crew will show us what to look for when prepping and sealing an attic and then blowing in cellulose to reach an R50 target.

running length: 17:33 date added: 1/24/11

Health & Safety Series: Mold & Moisture

WxTV jumps back into our Health & Safety Series with this episode dealing with mold and moisture problems. We'll travel to the states of Washington and Maryland to look at three homes with existing mold problems and listen to how these crews handled this challenging health issue.

running length: 14:23 date added: 1/14/11

California's Energy Efficiency Standards for Residential and Nonresidential Buildings

Title 24, Part 6, of the California Code of Regulations

The Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce California’s energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods.

2008 Standards - Effective January 1, 2010

California’s building energy standards (along with those for energy efficient appliances) have saved more than $6 billion in electricity and natural gas costs since 1978. It is estimated the standards will save an additional $23 billion by 2013.

The current 2003 standards may be downloaded from the Web pages listed above, or to obtain a hard copy, contact the Energy Commission’s publications unit at 916-654-5200.

If you have questions about Title 24:
Energy Standards Hotline
E-mail: title24@energy.ca.gov
Phone: 916-654-5106 or 1-800-772-5306 (toll free in Calif.)
City of Seattle: DIY Energy Audit


Date visited: 3/15/2011
The Code College Initiative is designed to address the building and energy code and building science training needs of the building industry, including code officials, trade agencies, builders, and trade groups across the nation. Code College presents objective, industry-sponsored online training from national experts that bring the audience to the field with our “online jobsite” approach available 24/7 for the ultimate convenience of the building professional.

Learn more about...

Advertising on the Code College Network

Want to reach 1000s of people in the construction industry with information about your product? BCAP’s Cosmina Panetti explains the concept behind the code college network and highlights the many reasons why product manufacturers and industry professionals should take advantage of this exceptional marketing venue. Double-click on the video for a full-screen version of this 3-minute video.
Code College Online Video Training Offerings

To watch a video, click on thumbnails.

RESIDENTIAL VIDEOS

BUILDING ENVELOPE > Insulation: Rigid Foam Insulation

Overview of Rigid Foam Insulation

Doug Bilbee, Residential Technical Specialist, Dow Building Materials, explains the benefits of using insulated foam sheathing in to increase energy efficiency and help prevent moisture/mold problems.

Exterior Wall Sheathing

Wood framing typically represents 25% of the surface area of walls, so the proper installation of insulated foam sheathing can prevent thermal bridging and increase energy efficiency in a house.

Exterior Basements and Slabs

Insulating the exterior foundation walls helps the concrete stay warm and uses thermal mass properties to help keep the basement warmer. Find out how to install exterior insulated foam sheathing.

http://www.codecollegenetwork.com/video_center/
Alliance to Save Energy (ASE)

The Latest in Energy Efficiency

President Obama’s Conference on Rising Oil, Gas Prices Prompts Renewed Call for Increased Energy Efficiency by Alliance to Save Energy
March 11, 2011
The Alliance to Save Energy echoed President Obama’s call at today’s White House news conference for bipartisan cooperation by members of Congress to advance energy efficiency as oil and gas prices continue to rise.
More

Can I Get a Tax Credit for That?
March 11, 2011
No one likes filling out their taxes. But, for consumers making energy-efficient purchases, tax season might help you keep a little extra cash in your wallet.
More

Alliance to Save Energy Says Greater U.S. Energy Efficiency Can Counter Spiking Oil, Gas Prices That Threaten Economic

http://ase.org/ Date visited: 3/15/2011
Building Energy Efficient Codes Network

Topics: Homes and Buildings, Policy, Codes and Standards

The Building Energy Efficient Codes Network is the Alliance's coalition to influence national public policy and public opinion on energy efficient codes.

Overview:

The Building Energy Efficient Codes Network (BEECN) engages Congress and other elected officials, industry leaders, code officials, and the media in support of set energy code targets for homes and commercial buildings. The broad-based coalition also advocates adequate resources for the adoption and enforcement of energy codes for all new buildings.

BEECN unites key stakeholders in an integrated campaign of lobbying, media, and grassroots advocacy in support of federal legislation that will set America on a path of continuous improvement that will lead to net zero energy buildings by 2030.

What's New

- Policy Summit on Capitol Hill: Energy Efficiency Across the Smart Grid
  - September 17, 2010
- EE Global Forum Attracts International Energy Efficiency Leaders
  - February 17, 2011
- Energy Efficiency Global Forum 2011: In Brussels in April
  - January 31, 2011
- Poll Energy Efficiency Key to Reducing Costs in Federal Government Buildings
  - November 5, 2010
- Code to Vastly Improve Energy Efficiency of Home, Commercial Building Construction
  - November 4, 2010
- Alliance, Homebuilders Join Forces to Advocate for Better Efficiency Codes
  - July 30, 2010
- Commercial and Industrial Insulation: The Forgotten Technology
  - June 1, 2010

http://ase.org/programs/building-energy-efficient-codes-network

Date visited: 3/15/2011
Welcome to the

Michigan Bureau of Construction Codes Online Code Training Series

As our statewide construction codes are revised and updated we are providing this e-learning programming to educate the industry on building product information, installation details and performance standards guidance to meet the revised codes. Through the kind support of our industry sponsors, Building Media, Inc., (www.buildingmedia.com) is working in partnership with the Bureau of Construction Codes to develop and provide this unique Internet-based training approach for building and design communities to disseminate and communicate these new and revised construction codes.

The purpose of this online building academy is to provide readily accessible training to building department personnel, builders and architects. The goal of this training program is to:

1. Educate building department personnel to have a greater knowledge and understanding of the codes so they can effectively enforce and inspect for building code regulations
2. Assist builders to construct better buildings that are in compliance with the new state building codes
3. Instruct architects and engineers on understanding the new codes that will be reflected in their designs and engineering.

Click on the buttons on the left to enter the learning modules.

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On Capitol Hill, NASEO Advocates for Full Funding of U.S. State Energy Program

With debate on the FY ’11 federal budget in full swing, the National Association of State Energy Officials is urging the Senate to fully fund the U.S. State Energy Program (SEP), the only Department of Energy program that provides cost-shared formula funds directly to states for energy-related economic development. SEP allows states to determine which energy priorities to target.

The State Energy Program has maintained bipartisan support from governors and Congress for 30 years and focuses on energy efficiency and renewable energy projects that address each state’s unique energy priorities and opportunities. Each dollar of federal SEP funding is matched with an estimated $10.71 of state and private funds, and yields $7.22 in annual energy cost savings, according to a Department of Energy national lab study.

www.naseo.org  Date visited: 3/15/2011
For More Information:

• Residential Energy Services Network
  http://resnet.us
  - Mission: establish and maintain the standards of quality for evaluating building energy performance and increase the opportunity for ownership of high performance buildings

• Energy Efficient Homes Midwest
  http://www.eehmidwest.com/
  - Midwest agency
  - Certifies most raters in Michigan
Additional Training Resources

U. S. Department of Energy
Building Energy Codes Program

Additional Training Resources:
http://www.energycodes.gov/events/other_resources.stm

- Several additional training resources
- ICC and ASHRAE links
- Professional and trade organizations
- State-specific resources
Interesting Web Links

ASHRAE Building Science Article

California Title 24: Online Learning
http://www.energy.ca.gov/title24/

City of Seattle, WA: DIY Home Energy Audit

Efficient Windows Collaborative
http://www.efficientwindows.org/

EPA Energy Star Program
http://www.energystar.gov/

Michigan Code Watch: Online Code Training
http://www.michigancodes.com/

MIT Open Courseware
http://ocw.mit.edu/index.htm

Montana Weatherization Training Center
http://weatherization.org/
Interesting Web Links

Oak Ridge National Laboratory: Building Envelope Research
http://www.ornl.gov/sci/roofs+walls/insulation/ins_01.html

Southface Learning Center
www.southface.org/learning-center/trainings/

Southface Online Training
www.southfaceonlinetraining.org/

U. S. Energy Information Administration: Key Terms Glossary
http://www.eia.doe.gov/a-z_index/Energya-z_a.html

U. S. Green Building Council (LEED Rating System)
www.usgbc.org

USGBC: Education
http://www.usgbc.org/education

U.S. DOE: Building Energy Codes Program
http://www.energycodes.gov

U.S. DOE: Energy Savers Blog
Important Terminology

Heat Flow Terms:

• R-value
• U-value
• C-factor
• F-factor
R-value

A measure of thermal resistance, or how well a material or series of materials resist the flow of heat. R-value is the reciprocal of U-value. Materials with higher R-values resist better than those with lower R-values.

Unit of measure: hr ft² °F / BTU

\[ R = \frac{1}{U\text{-value}} \]
U-value

A measure of how well a material or series of materials conduct heat. U-values for window and door assemblies are the reciprocal of the assembly R-value. Materials with lower U-values resist heat better than those with higher U-values.

Unit of measure: BTU / hr ft² °F

\[ U = \frac{1}{R-value} \]
C-factor is also a rate of heat flow through a homogenous material, but could be for any given thickness.

Unit: BTU / hr ft\(^2\) °F

C-factor does not include soil or air films
The perimeter heat loss factor for slab-on-grade floors, expressed in **BTU / hr ft. °F**
Glazing/Fenestration

- Fenestration
- Solar Heat Gain Coefficient
- Shading Coefficient
The terms "fenestration", "window", and "glazing" are often used interchangeably. However, fenestration refers to the design and position of windows, doors and other structural openings in a building (including frames).
Fenestration

• U-values for windows can be measured at the center of the glass or can be expressed as a whole unit U-value

• National codes such as IECC and IRC require a unit U-value

• Codes have specific requirements for testing and labeling of window U-values
Solar Heat Gain Coefficient (SHGC)

SHGC is the glazing's effectiveness in rejecting solar heat gain. It is a part of a system for rating window performance used by the National Fenestration Rating Council (NFRC).

It is the fraction of incident solar radiation admitted through a window, both directly transmitted and absorbed, then subsequently released inward. It is expressed as a number between 0 and 1. **The lower a window's SHGC, the less solar heat it transmits.**

SHGC is gradually replacing the older index, Shading Coefficient (SC), in design standards.


Date Visited: 3/15/2011
Shading Coefficient

The ratio of solar heat gain through fenestration, with or without integral shading devices, to that occurring through un-shaded 1/8-in thick double-strength glass.

If you are using glass whose performance is listed in terms of SC, you may convert to SHGC by multiplying the SC value by 0.87.
Climate Zone / Degree Days

- Climate Zone
- Heating Degree Days
- Cooling Degree Days
A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one-day, when the mean temperature is less than 65°F (18.3°C), there exists as many degree-days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F (18.3°C).

Example for any given day:
High Temp = 50° F
Low Temp = 20° F
Average Temperature = 50° + 20° F = 70/2 = 35° F
Degree Day = 65°F - 35° F = 30° F
Therefore, the day was a 30° HDD

Totaling the degree-days generated each day for the entire year represents the annual Heating Degree Days which is abbreviated as HDD.

For any one-day when the mean temperature is more than 50°F (10°C), there are as many degree-days as degrees Fahrenheit temperature difference between the mean temperature for the day and 50°F (10°C).

Example for any given day:
High Temp = 80°F
Low Temp = 40°F
Average Temperature = 80°F + 40°F / 2 = 120/2 = 60°F
Degree Day = 60°F - 50°F = 10°F
Therefore, the day was a 10°F CDD

Totaling the degree-days generated each day for the entire year represents the annual Cooling Degree Days which is abbreviated as CDD
Other Key Terms

• Air Barrier
• Mass Wall
• Semi-heated Space
**Air Barrier**

The principal function of the air barrier is to prevent both the infiltration of outdoor air into a building and the exfiltration of indoor air to the outside.

Air leakage can cause problems such as loss of energy and deposition of moisture in the walls.
Mass Walls

Wall with thermal heat sinking capacity exceeding 7 BTU/ft$^2$°F or 5 BTU/ft$^2$°F provided that the wall has material unit weight not greater than 120 lb/ft$^3$.

It is generally constructed of masonry or heavy wood and serves as a heat sink.
Semi-Heated Space

An enclosed space within a building that is heated by a heating system whose output capacity is greater than or equal to 3.4 BTU/hr.ft$^2$ of floor area, but is not a conditioned space.
Equipment Efficiency Terms

- Energy Efficiency
- Coefficient of Performance (COP)
- Energy Efficiency Ratio (EER)
- Seasonal Energy Efficiency Ratio (SEER)
- Annual Fuel Utilization Efficiency (AFUE)
**Energy Efficiency**

Energy Efficiency = Useful Energy OUTPUT / energy INPUT

**Example:** The IRC requires the heating appliances to be 78% energy efficient or 0.78.

Practically, efficiency cannot be 100% or 1 because energy is always lost in appliances in the form of sound or light energy.
The ratio of the rate of heat exchange to the rate of energy input in consistent units for a complete cooling/heating system as tested under a nationally recognized standard or designated operating conditions.
The ratio of net cooling capacity of an equipment item in Watts (1 BTU / hr = 0.29 Watts) to the total rate of power input (in Watts) under designed operating conditions.

\[
\text{EER} = \frac{\text{Net cooling capacity (in Watts)}}{\text{Power input (Watts)}}
\]
Seasonal Energy Efficiency Ratio (SEER)

The ratio of the total cooling output of an air conditioner during its annual usage period of cooling to the energy input during the same period.

\[ \text{SEER} = \frac{\text{Cooling output}}{\text{Energy input}} \]

- New equipment ranges from about 10 to 16 SEER
- Higher SEER ratings indicate more efficient equipment
Annual fuel utilization efficiency is the combustion heating equipment efficiency and is abbreviated as AFUE. AFUE typically ranges from about 78 to 96% AFUE.

*Higher AFUE ratings indicate more efficient equipment*
Basic Energy Units

- **British Thermal Unit (BTU):**
  - 1 BTU is the amount of heat energy required to raise the temperature of one pound of water by 1°F, at sea level (It takes about 2,000 BTUs to make a pot of coffee).

- **Joules:**
  - \(1,000 \text{ joules} = 1 \text{ Kilojoules} = 1 \text{ BTU}\)
  - So, 2 million joules to make a pot of coffee!!

- **Other measures such as CALORIES**
Heat Energy and Heat Flow

• Heat is a form of energy

• Flows in 3 ways:
  – CONDUCTION
  – CONVECTION
  – RADIATION

http://www.savenrg.com/norbs.jpg
https://www.cresis.ku.edu/iceicebaby/?m=201010

Date visited: 3/15/2011
CONDUCTION

• Higher to lower temperature (higher → lower energy)

• Transfer of heat through a substance, resulting from a difference in temperature between different parts

• Rate of heat flow between 2 regions is directly proportional to:
  – The temperature difference between them and
  – Conductivity of the substance
  – Contact area

• Example: Heat flowing from inside conditioned space to outside unconditioned space through walls
CONVECTION

- Warmer air rises
- **Convection is the mode of heat transfer in fluids** (air and liquids)
  - Air expands when heated—density decreases
  - Warmer air rises through the surrounding cooler air
  - Cooler air that flows in to replace the rising warmer air gets heated and also rises
  - Thus, a current called a convection current, becomes established in the air
  - The same principle causes land and sea breezes
Radiant energy is energy that comes from a source and travels through space (example: solar radiation)

- The Sun: The most common source of radiant energy
- The Sun's light and heat cannot reach us by conduction or convection because space is almost completely empty (VACUUM)

When sunlight hits the earth, its radiant energy is absorbed or reflected
Energy in Building Science

• A building’s energy performance is closely related to other aspects of building science such as:
  – MOISTURE
  – MOLD
  – VENTILATION

• Changes in construction details for one purpose can have unintended effects

• When designing for energy one should consider moisture and ventilation simultaneously

• In some states successful training programs for builders have been developed, which address these interrelationships
Moisture in Buildings

Excessive moisture in buildings, combined with favorable temperature conditions, can foster:

• Mold growth
• Air quality problems
• Health problems
• Decay of building materials and failure of the envelope

According to EPA:

*The key to mold control is moisture control*
Envelop Air/Moisture Flows

Envelop Air/Moisture Flows

Convective loop within wall

Exfiltration of moisture laden air

Air leakage into and out of wall

Wind wash

Source: Building Science Primer by Patrick Huelman, University of Minnesota, July 2004
Envelope Moisture Formation

Moisture condenses on the cold underside of the plywood sheathing.

Warm, moist air enters the roof assembly through openings around the recessed light fixture.

Condensed moisture drips down into the space.

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Source: Building Science Primer by Patrick Huelman, University of Minnesota, July 2004
## Moisture Control

### Key Components of a Cold Climate House

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<td>Full-coverage, warm-side vapor retarder</td>
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<td>Effective ground-moisture/soil gas control</td>
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<td>Safe, efficient space heating &amp; cooling</td>
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<td>Managed mechanical ventilation</td>
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<tr>
<td>Low-toxicity materials, finishes &amp; furnishings</td>
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</tr>
<tr>
<td>Efficient &amp; safe appliances &amp; lighting</td>
<td><img src="Image" alt="Black house" /></td>
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</tbody>
</table>

*Source: Building Science Primer by Patrick Huelman, University of Minnesota, July 2004*
Ventilation

• Outdoor air ventilation addresses most indoor air quality issues:
  - Sick Building Syndrome
  - Moisture and Mold Problems
  - Second-hand Tobacco Smoke
  - Material Out-gassing
  - Multiple Chemical Sensitivity

• Good ventilation dilutes pollutants

• Ventilation can increase energy consumption, which can be mitigated by the use of heat exchangers

Source: ‘Ventilation Basics and Beyond’, Presentation made by Jeff Tiller at 2004 National State Building Energy Codes Conference
Why Ventilate?

• **Moisture control**
  - Reduce excessive moisture harmful to the building structure
  - Reduce excessive moisture that is a source of mold and mildew growth

• **Eliminate odors and pollutants** that are harmful to human health

*Source: ‘Ventilation Basics and Beyond’, Presentation made by Jeff Tiller at 2004 National State Building Energy Codes Conference*