

Michigan Energy Code Training and Implementation Program

1.0 Hour Advanced Program Course Number 16202

Residential Energy Plan Review



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Midwest Energy Efficiency Alliance

**School of Planning, Design
& Construction**

Michigan State University
East Lansing, Michigan

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1 Hour Plan Review:

PR only

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Acknowledgement and Disclaimer

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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)**.

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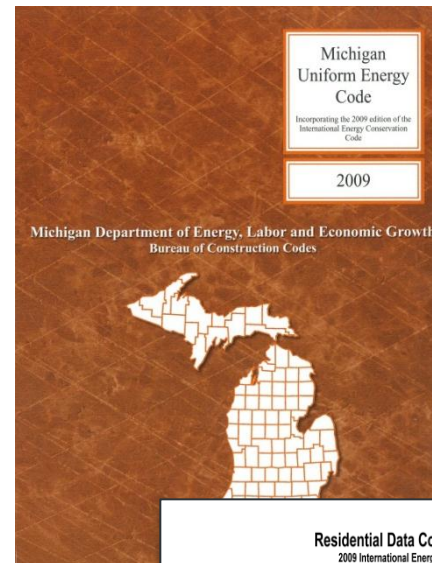
Project Objectives

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

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

Presentation Overview

- Applicability of the MUEC
- Prescriptive Compliance Method
- Trade-off Compliance Method
- Performance Compliance Method



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: 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
Multifamily: Apartment

Project Type: New Construction Addition to existing building

Item Number ¹	Pre-Inspection/Plan Review	Code Value	Verified Value
PR1 [103.2]	Construction drawings and documentation submitted and available. Documentation sufficiently demonstrates energy code compliance.		
PR2 [403.6]	HVAC loads calculations: Heating system size(s): Cooling system size(s):	kBtu/yr kBtu/yr	

Additional Comments: _____

Pre-Inspection/Plan Review

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 Program

Date visited: 3/14/2011

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- WHY BUILDING ENERGY CODES
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Digital copies of the ASHRAE Standard 90.1-2007 (I-P Edition) and the 2009 International Energy Conservation Code® are now available!

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RECENT UPDATES

2010 Building Energy Codes Annual Report Released
posted 03.04.2011

Store + Score Application Released
posted 03.04.2011

DOE proposed changes to IgCC PV 2.0
revised 03.10.2011

CODES IN THE NEWS

Notice of Public Meeting: Presenting and Receiving Comments to DOE Proposed Changes to the IgCC
posted 03.10.2011

A Chance Encounter with the Massachusetts Stretch Energy Code
Source: New Buildings Institute, 03.02.2011

Energy Efficiency key to Zero Energy Commercial Buildings
Source: Energy Saving Association, 02.21.2011

2009 MUEC Plan Review

Training Module



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Applicability (*Section 101.4*)

Determine if the project must comply with the 2009 MUEC requirements.

The following **MUST** comply:

- New construction
- Additions, alterations, renovations, or repairs (new/altered portion only with 10 specified exceptions) (*Section 101.4.3*)
- Change in occupancy or use that increases fossil fuel or electrical energy demand (*Section 101.4.4*)
- Change in space conditioning (*Section 101.4.5*)
- Residential portions of mixed occupancy buildings (*Section 101.4.6*)

Applicability (*Section 101.4*)

Determine if the project must comply with the 2009 MUEC requirements.

The following need not comply:

- Existing buildings (*Section 101.4.1*)
- Historic buildings (*Section 101.4.2*)
 - Listed in State or National Register of Historic Places
 - Designated historic by local or state jurisdiction
 - Eligible to be listed in State or National Register of Historic Places
- Low energy buildings (peak design rate less than 3.4 Btu/hr·ft² or 1.0 W/ft²) (*Section 101.5.2*)
- Unconditioned buildings (*Section 101.5.2*)

Submittal Documents (*Section 103.1*)

Construction documents, special inspection programs, structural programs, and other data shall be:

- Submitted in 1 or more sets for permit application
- Prepared by or under the supervision of a registered design professional (when required by 1980 PA 299, MCL 339.101 to 339.2721)

Building Officials may require additional documents to be prepared by a registered design professional.

Information on Documents (*Section 103.2*)

Construction documents must:

- Be drawn to scale
- Be drawn upon suitable material (Code Official approval needed for submittal of electronic drawings)
- Clearly show the location, nature, and extent of the proposed work



ANSI/ASHRAE/IESNA Standard 90.1-2007. U. S. DOE Building Energy Codes Program.

<http://www.energycodes.gov/becu/trainers.stm> Date visited: 6/28/2011

Information on Documents (*Section 103.2*)

Construction documents must detail:

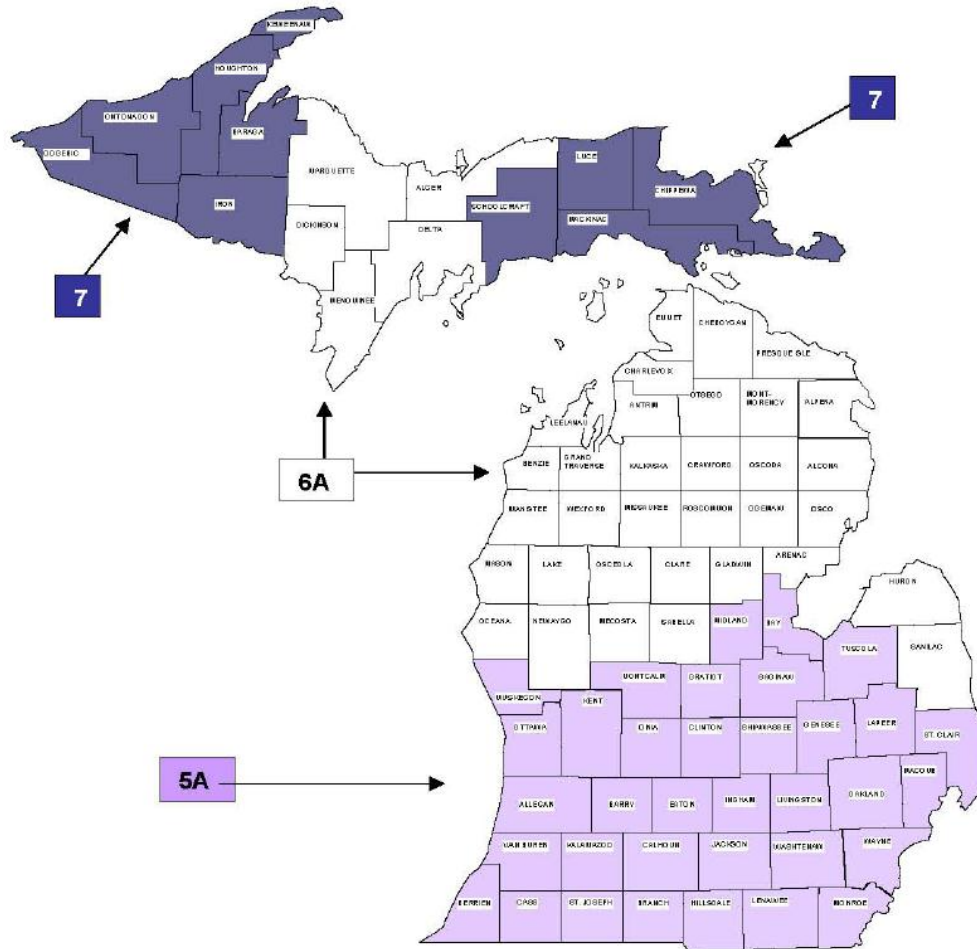
- Locations and types of insulation materials and R-values
- Locations and details of fenestration including U-factors and air infiltration rates
- Area weighted U-factors calculations
- Mechanical system equipment type, size, and efficiency and the supporting design criteria
- Service water heating system equipment type, size, and efficiencies
- Economizer descriptions
- Equipment and system controls
- Fan motor horsepower (hp) and controls
- Duct location, sealing, and insulation information
- Pipe insulation and locations
- Lighting fixture schedule including wattage and control information
- Air sealing methods

Approval of Documents (*Section 103.3.1*)

Construction documents approved by the Code Official shall be stamped “Reviewed for Code Compliance”.

One set to be retained by the Code Official, the other returned to applicant to be kept at the job site. This set shall be made readily available for inspections.

Determine Applicable Climate Zone



**Figure 301.1a
Climate Zones**

2009 Michigan Uniform Energy Code Rules - Residential. Michigan Bureau of Construction Codes.

http://www.michigan.gov/documents/dleg/dleg_bcc_2007_052lg_muec_residential_337936_7.pdf Date visited: 6/28/2011

Determine Applicable Climate Zone

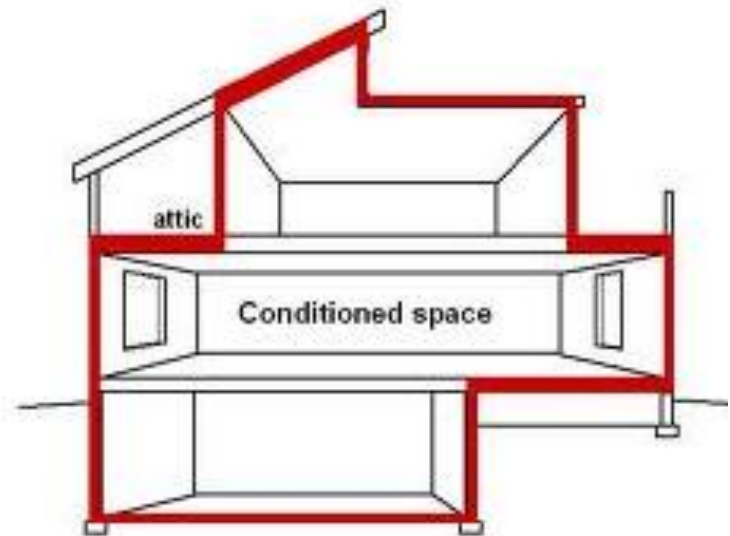
Table 301.1
Climate Zones by County

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

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

Identify the Conditioned Spaces

An area or room within a building being heated or cooled, containing un-insulated ducts, or with a fixed opening directly into an adjacent conditioned space.



Verify that the Mandatory Provisions are Met

These must be met for ALL compliance methods!

These provisions include:

- General requirements (*Section 401*)
- Air leakage (*Section 402.4*)
- Maximum fenestration U-factor (*Section 402.5*)
- System controls (*Section 403.1*)
- Duct sealing (*Section 403.2.2*)
- Building cavities as ducts (*Section 403.2.3*)
- Mechanical system piping insulation (*Section 403.3*)
- Circulating hot water systems (*Section 403.4*)
- Mechanical ventilation (*Section 403.5*)
- Equipment Sizing (*Section 403.6*)
- Systems serving multiple dwelling units (*Section 403.7*)
- Snow melt system controls (*Section 403.8*)
- Pools (*Section 403.9*)

Determine Compliance Method

Prescriptive

Trade-off

Performance

“Prescriptive Packages Approach”

“Trade-off Approach”
(UA)

“Performance Approach”

Residential Data Collection Checklist
2009 International Energy Conservation Code
Climate Zone 2

Date: _____ Name of Evaluator: _____
Building Name & Address: _____ Conditioned Floor Area: _____
Building Contact: Name _____ Phone _____ Email _____
Compliance Approach: Prescriptive (IECC 1.2 or IECC 1.3) UA Trade-Off (IECC 1.4) Building Performance (IECC 1.5)
Site: _____ Location: _____
Building Type: 1- and 2-Family, Detached Single-Family, Attached Multifamily Nonresidential

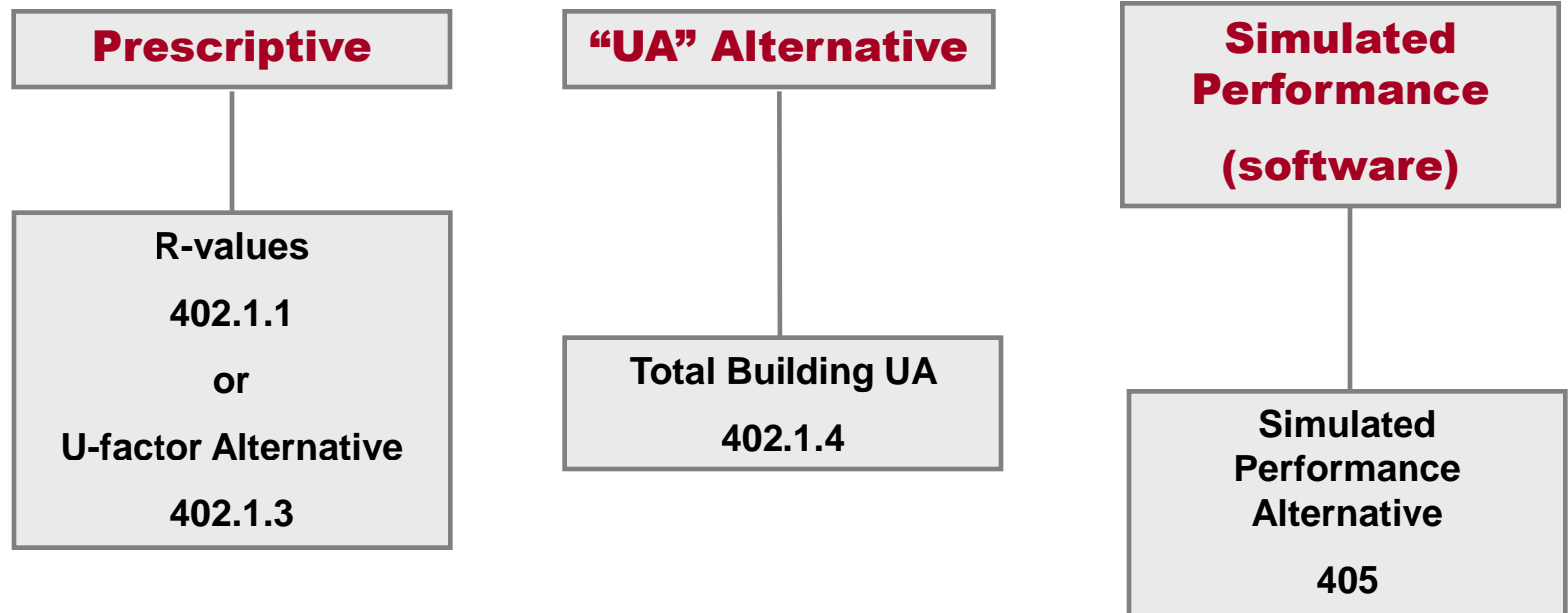
Item Number	Item Description	Code Value	Verified Value	Complies
F01	Foundation Inspection	Unheated R-5		<input type="checkbox"/>
F02	Slab edge insulation R-value installed per manufacturer's instructions.	Heated: R-5		<input type="checkbox"/>
F03	Slab edge insulation depth/length	R-5		<input type="checkbox"/>
F04	Basement wall exterior insulation R-value installed per manufacturer's instructions.	10 ft. or to top of basement floor		<input type="checkbox"/>
F05	Crawl space wall insulation R-value installed per manufacturer's instructions.	R-5 (cavity) R-13 (cavity)		<input type="checkbox"/>
F06	Snow melt controls			<input type="checkbox"/>
F07	Insulation protection			<input type="checkbox"/>



Residential Requirements of the 2009 IECC. U. S. DOE Building Energy Codes Program.

<http://www.energycodes.gov/becu/trainers.stm> Date visited: 6/28/2011

Verify Compliance Requirements



Prescriptive Method

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Prescriptive Method

Verify that the following provisions are met:

- General building thermal envelope (*Section 402.1*)
- Specific insulation requirements (*Section 402.2*)
- Fenestration (*Section 402.3*)
- Duct insulation (*Section 403.2.1*)
- Lighting equipment (*Section 404.1*)



General Building Thermal Envelope

(Section 402.1)

Insulation and fenestration criteria *(Section 402.1.1)*

- Meet requirements of Table 402.1.1 for the appropriate climate zone

R- value computation *(Section 402.1.2)*

- Do not include other building material R-values or air films
- Layered insulation
 - Add R-values of layers to get the component R-value
- Blown insulation
 - Use manufacturer's settled R-value

U-factor alternative *(Section 402.1.3)*

- Assembly U-factor not more than that listed in Table 402.1.3

Insulation and Fenestration Criteria (Section 402.1.1)

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION <i>U</i> -FACTOR	SKYLIGHT ^a <i>U</i> -FACTOR	CEILING <i>R</i> -Value	WOOD FRAME WALL <i>R</i> -VALUE	MASS WALL <i>R</i> -VALUE ^f	FLOOR <i>R</i> -VALUE	BASEMENT ^b WALL <i>R</i> -VALUE	SLAB ^c <i>R</i> -VALUE AND DEPTH	CRAWL SPACE ^c WALL <i>R</i> -VALUE
5A	0.35	0.60	38	20 or 13 + 5 ^e	13/17	30 ^d	10/13	10, 2ft	10/13
6A	0.35	0.60	49	20 or 13 + 5 ^e	15/19	30 ^d	15/19	10, 4ft	10/13
7	0.35	0.60	49	21	19/21	38 ^d	15/19	10, 4ft	10/13

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

U-factor Alternative (Section 402.1.3)

Table 402.1.3
Equivalent U-Factors^a

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass wall U-Factor ^b	Floor U-Factor	Basement Wall U-Factor ^d	Crawl Space Wall U-Factor ^c
5A	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6A	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7	0.35	0.60	0.026	0.057	0.057	0.026	0.050	0.065

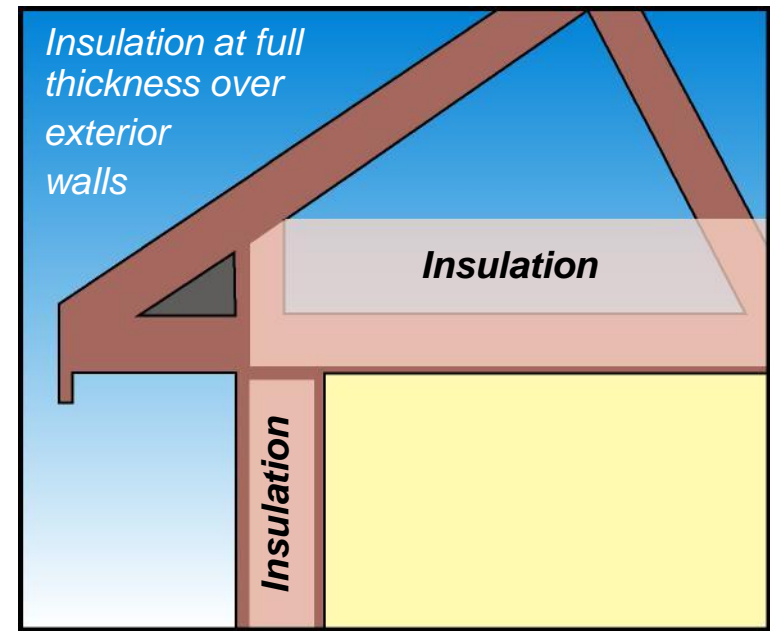
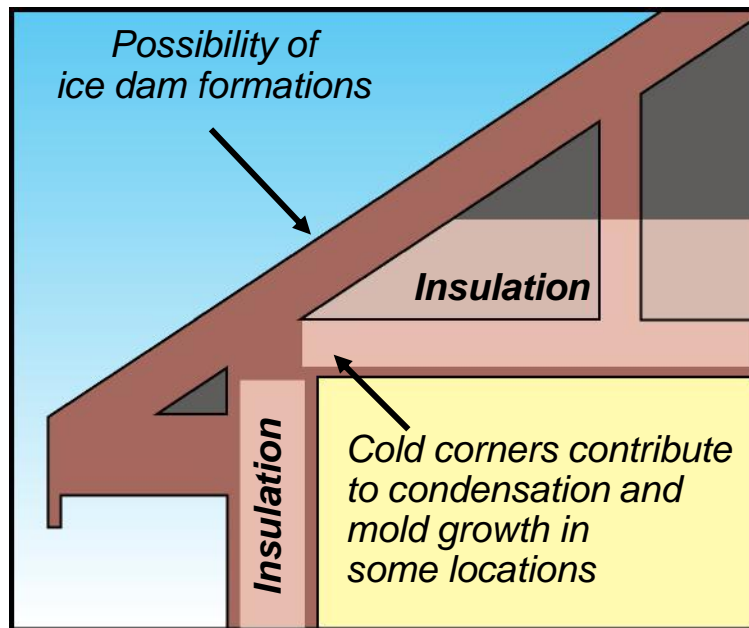
- Nonfenestration *U*-factors shall be obtained from measurement, calculation, or an approved source.
- When more than half the insulation is on the interior, the mass wall *U*-factors shall be the same as the frame wall *U*-factor in Zones 5 to 7.
- Basement wall *U*-factor requirements shown in Table 402.1.3 include wall construction and interior air films, but exclude soil conductivity and exterior air films.
- 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

Specific Insulation Requirements (Section 402.2)

Ceilings with attic spaces (Section 402.2.1)

- Allows raised heel/energy truss credit (R-38 instead of R-49) if insulation is full height over exterior wall (prescriptive only)



Specific Insulation Requirements

(Section 402.2)

Ceilings without attic spaces *(Section 402.2.2)*

- Minimum R-30 (maximum 500 ft² or 20% of total insulated ceiling, whichever is less)
- Shall not apply to U-factor alternative approach or UA alternative

Access hatches and doors *(Section 402.2.3)*

- Full ceiling insulation thickness
- Weather-stripped

Mass walls *(Section 402.2.4)*

- Defines mass walls
- When more than half the insulation is on the interior, climate zones 5-7 require higher insulation

Specific Insulation Requirements (Section 402.2)

Steel-frame ceilings, walls, and floors (Section 402.2.5)

- Must meet the minimum insulation requirements of Table 402.2.5 or must meet assembly requirements of Table 402.1.3
- Walls must use continuous insulation over the framing members

Floors (Section 402.2.6)

- Insulation must be in permanent contact with the underside of the subfloor decking
- Minimum R-19 permitted if cavity is completely filled

Specific Insulation Requirements (Section 402.2)

Protection of exposed foundation insulation (*Section 303.2.1*)

- Requires exterior foundation insulation for basement walls, crawl space walls, and slab on grade floors to have a rigid, opaque, weather-resistant protective covering
- Must extend 6" below grade

Basement walls (*Section 402.2.7*)

- 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

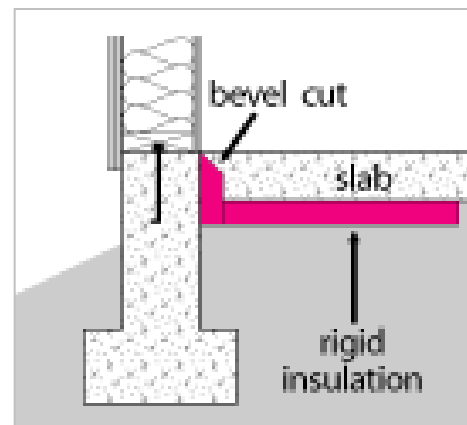
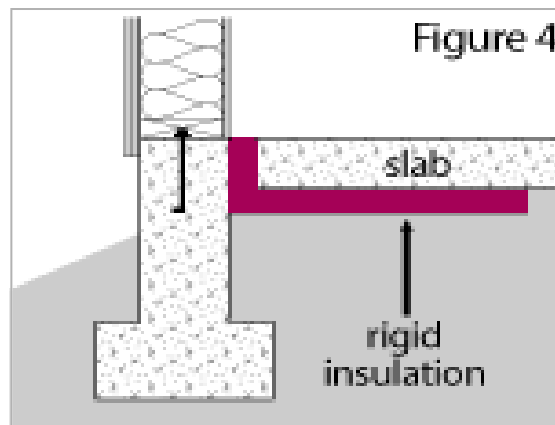
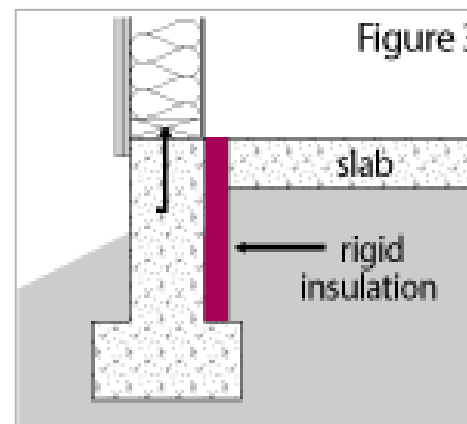
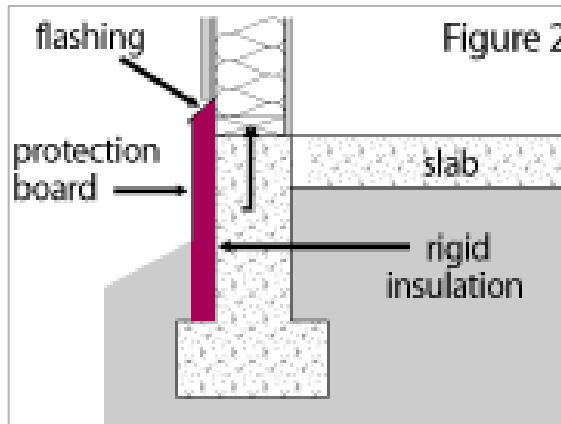
Specific Insulation Requirements (Section 402.2)

Slab-on-grade floors (Section 402.2.8)

- 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)
- Insulation shall extend from top of slab on outside or inside of foundation wall
- Insulation between exterior wall and the interior slab can be beveled at a 45° angle away from the exterior wall
- R-5 shall be added when slabs are heated, such as radiant floor slabs

Specific Insulation Requirements (Section 402.2)

Slab-on-grade floors (Section 402.2.8)



Specific Insulation Requirements (Section 402.2)

Crawl space walls (Section 402.2.9)

- As an alternative to insulating the floor above, unvented crawl space walls may be insulated
- Insulation must be permanently fastened
- Crawl space wall insulation must extend from the top of the wall to the inside finished grade and then 24" vertically or horizontally
- Crawl spaces not vented to the exterior must be mechanically vented (1 cfm exhaust per 50 ft²) or conditioned as part of the building envelope
- Exposed ground surface must be covered by with a Class I vapor barrier (sheet polyethylene or non-perforated aluminum foil) with 6" overlap, sealed or taped seams, and must extend a minimum of 6" up and be attached to the stem walls

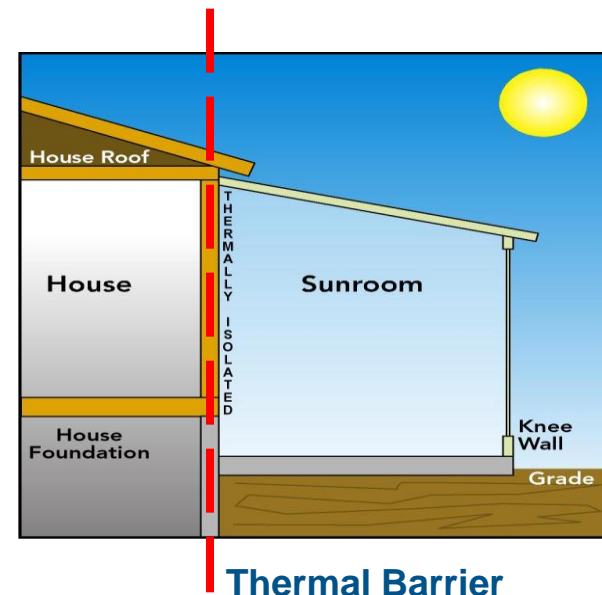
Specific Insulation Requirements (Section 402.2)

Masonry veneer (Section 402.2.10)

- Insulation not required on the brick ledge

Thermally isolated sunroom insulation (Section 402.2.11)

- Ceilings insulated to a minimum R-24
- Walls insulated to a minimum R-13
- Must be thermally isolated
- Separate heating or cooling system or zone



Fenestration (*Section 402.3*)

U-factor (*Section 402.3.1*)

- Can use area-weighted averages to satisfy U-factor requirements

SHGC Requirements (*Section 402.3.2*)

- Deleted by Michigan

Presenter's note: SHGC still required for commercial



Fenestration (*Section 402.3*)

Glazed fenestration exemption (*Section 402.3.3*)

- A maximum of 15 ft² may be exempt from the U-factor requirements of Section 402.1.1 per dwelling unit
- Does not apply if U-factor alternative approach or total UA alternative is used

Opaque door exemption (*Section 402.3.4*)

- One side-hinged door opaque door assembly up to 24 ft² is exempt from the U-factor requirements of Section 402.1.1
- Does not apply if U-factor alternative approach or total UA alternative is used

Fenestration (*Section 402.3*)

Thermally isolated sunroom U-factor (*Section 402.3.5*)

- Windows and door maximum U-factor of 0.50
- Skylight maximum U-factor of 0.75
- New windows and doors in the separating wall must meet the thermal envelope requirement

Replacement fenestration (*Section 402.3.6*)

- Replacement windows and skylights shall meet the U-factor requirements in Table 402.1.1

Duct Insulation (Section 403.2.1)

- Supply ducts in attics must have R-8 insulation
- All other ducts must have R-6 insulation
- Ducts located completely inside building thermal envelope are exempt



Lighting Equipment (*Section 404.1*)

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

Trade-off Method

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Total UA Alternative (*Section 402.1.4*)

- UA = sum of U-factor x assembly area
- UA calculations shall be consistent with the ASHRAE Handbook of Fundamentals
- Typically will use REScheck Software to show compliance
- Can be demonstrated using long-hand forms
- **Mandatory provisions MUST still be met**



REScheck Compliance Basics

Before verifying compliance using REScheck, you will need:

- 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

Residential Plan Review

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

REScheck™ **RESIDENTIAL PLAN REVIEW** **QUICK REFERENCE GUIDE**



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

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

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

Step 1: Verify the Project Information matches the building plans. The Energy Code, Location, and Construction Type will impact energy code compliance.

Construction Site:
Permit Date: March 15, 2010

Owner/Agent:
JJ Jones

Designer/Contractor:
Done Right Construction

Step 2: Verify Compliance (UA Trade-Off or Performance Alternative).

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

Compliance: 2.1% Better Than Code **Maximum UA: 582** **Your UA: 570**
 The % Better or Worse Than Code Index reflects how close compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

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

Assembly	Gross Area	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Window 2: Vinyl Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Back	149	0.350	52		
Door 2: Solid Orientation: Back	40			0.500	20
Exterior Wall 3 East: Wood Frame, 16" o.c. Orientation: Left Side	492	20.0	0.0		29
Exterior Wall 4 West: Wood Frame, 16" o.c. Orientation: Right Side	632	20.0	0.0		36
Window 3: Vinyl Frame: Double Pane with Low-E SHGC: 0.40 Orientation: Right Side	15			0.350	5
Knee Wall West: Wood Frame, 16" o.c. Orientation: Left Side	69	20.0	0.0		4
Knee Wall East: Wood Frame, 16" o.c. Orientation: Right Side	84	20.0	0.0		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.

Assembly		Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Basement Wall 2: Solid Concrete or Masonry Orientation: Left Side Wall height: 9.0' Depth below grade: 4.5' Insulation depth: 9.0'	144	20.0	0.0	7		
Basement Wall 1: Solid Concrete or Masonry Orientation: Right Side Wall height: 9.0' Depth below grade: 4.5' Insulation depth: 9.0'		216	20.0	0.0		11
Basement Wall 3: Solid Concrete or Masonry Orientation: Front Wall height: 9.0' Depth below grade: 7.0' Insulation depth: 9.0'		684	20.0	0.0		31
Floor 1: All-Wood Joist/Truss, Over Unconditioned Space		783	30.0	0.0		26
Floor 2: Slab-On-Grade:Unheated Insulation depth: 4.0'		93		10.0		64

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.

Name - Title

Signature

Date

Project Notes:

Jones Residence
1000 Maple Street
Circle Construction
Done Right Construction
Plan 3677

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.

Step 11: If Air Sealing and Insulation are not verified via testing, the items listed must be verified by Visual Inspection.

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.

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, and 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

Insulation Rating	R-Value	
Ceiling / Roof	49.00	
Wall	20.00	
Floor / Foundation	30.00	
Ductwork (unconditioned spaces):	_____	
Glass & Door Rating	U-Factor	SHGC
Window	0.35	0.40
Door	0.50	NA
Heating & Cooling Equipment	Efficiency	
Heating System: _____	_____	
Cooling System: _____	_____	
Water Heater: _____	_____	
Name: _____	Date: _____	
Comments: _____		

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.

Simulated Performance Method

Training Module



MICHIGAN STATE
UNIVERSITY



MEEA
Midwest Energy Efficiency Alliance

**School of Planning, Design
& Construction**

Michigan State University
East Lansing, Michigan

Simulated Performance Alternative (Performance) (Section 405)

- 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:
 - Air-conditioners, etc. (no furnace trade-off!!)
 - Tight ducts or hydronic systems
 - Exterior shading, favorable orientation, thermal mass, etc.
- 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

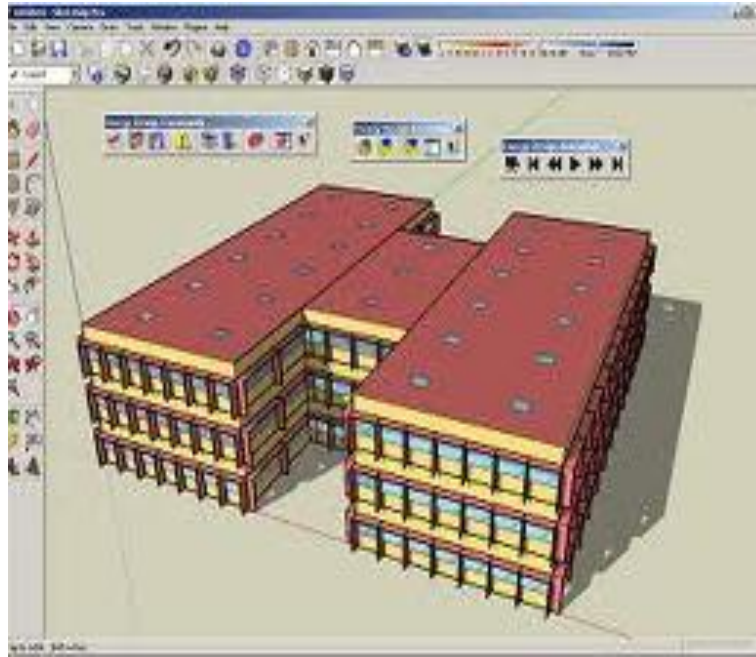
Residential Requirements of the 2009 IECC. U. S. DOE Building Energy Codes Program.

<http://www.energycodes.gov/becu/trainers.stm> Date visited: 6/28/2011

Simulated Performance Alternative (Performance) (Section 405)

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

Simulated Performance Alternative (Performance) (Section 405)

Mandatory requirements (*Section 405.2*)

- Verify that the mandatory provisions are met

Performance-based compliance (*Section 405.3*)

- Energy cost of proposed project must not exceed that of the standard building design
- Source energy multiplier Exceptions
 - For electricity use 3.16
 - For other fuels use 1.1

Simulated Performance Alternative (Performance) (Section 405)

Compliance software tools (*Section 405.4.1*)

- Methods and accuracy documentation must be given to the Code Official

Compliance report (*Section 405.4.2*)

- Program must generate a report showing compliance and must include the following
 - Address or identification of the project
 - Inspection checklist detailing components of the proposed design and results of the standard reference design and proposed design
 - Name of person generating the compliance report
 - Name and version of the software tool

Simulated Performance Alternative (Performance) (Section 405)

Additional documentation (Section 405.4.3)

- Code official may require the following additional documents
 - Standard reference design building component characteristics
 - Certification signed by the builder stating proposed design building component characteristics
 - Actual values used for software calculations of the proposed design

Simulated Performance Alternative (Performance) (Section 405)

Minimum capabilities (Section 405.6.1)

- Software must be capable of the following functions
 - Generate a standard reference design based on input from the proposed design
 - User unable to directly modify the standard reference design
 - Calculate the whole-building mechanical sizing of the standard reference design according to the International Residential Code (IRC) Section M1401.3
 - Calculations to consider indoor and outdoor temperatures and part-load ratios of mechanical system based on climate and sizing
 - Print an inspection checklist listing items from Table 405.5.2(1)



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