Michigan Energy Code Training and Implementation Program

1.0 Hour Advanced Program Course Number 16199
Residential Energy Additions, Alterations, Renovations, and Repairs

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

Residential Energy Additions, Alterations, Renovations, and Repairs:

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Course Number: 16199

1 Hour Specialty:
BI, MI, or registrants with only BO/PR but no inspector registration
Acknowledgement:

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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).

Project Objectives

To train building officials, inspectors, home builders, subcontractors, suppliers, engineers and architects in the requirements for additions, alterations, renovations, and repairs in the Michigan energy code for the purpose of:

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

- Requirements for Additions, Alterations, Renovations and Repairs
- Compliance Using REScheck

State Compliance Evaluation Checklists. U.S. DOE Building Energy Codes Program.
http://www.energycodes.gov/arra/compliance_checklists.stm

Date visited: 6/28/2011
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

Go To: www.energycodes.gov

Date visited: 3/14/2011
2009 MUEC Residential Additions, Alterations, Renovations, and Repairs

Training Module

School of Planning, Design & Construction

Michigan State University
East Lansing, Michigan
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)
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·ft$^2$ or 1.0 W/ft$^2$) (*Section 101.5.2*)
• Unconditioned buildings (*Section 101.5.2*)
Additions, Alterations, Renovations, and Repairs (Section 101.4.3)

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

Residential Requirements of the 2009 IECC. U. S. DOE Building Energy Codes Program.
Exceptions (assuming no net increase in energy use):

- Storm windows over existing fenestration
  - Neither the storm window nor the existing fenestration need to comply
Exceptions (assuming no net increase in energy use):

- Glass only replacements
  - In an existing sash and frame, new glazing need not comply
  - Example: baseball through a window
Exceptions (assuming no net increase in energy use):

- Exposed existing ceiling, wall, or floor cavities if already filled with insulation
  - Regardless of the R-value, previously filled cavities need not comply
Exceptions (assuming no net increase in energy use):

- Existing roof, wall, or floor cavity is not exposed
Exceptions (assuming no net increase in energy use):

• Reroofing for roofs where neither sheathing nor insulation exposed
  - If there is no insulation and either the sheathing or insulation is exposed, the roof insulation must be brought up to code
  - Can be insulated either above or below the sheathing

**Presenter’s note:** maximum of two layers allowed without requiring a tear-off
Exceptions (assuming no net increase in energy use):

• Replacement of existing doors in building thermal envelope will not require a vestibule or revolving door, assuming an existing one will not be removed
Exceptions (assuming no net increase in energy use):

- Replacement of less than 50% of luminaries in a space
  - Must not increase the interior lighting power
Exceptions (assuming no net increase in energy use):

• Replacement of only the bulb and ballast in existing luminaries
  – Must not increase the interior lighting power
Additions, Alterations, Renovations, and Repairs (Section 101.4.3)

Exceptions (assuming no net increase in energy use):

• Existing, unaltered 1- and 2-family dwellings
  - Replacement fenestration is not exempt as stated in Section 402.3.6 (entire window units)
Exceptions (assuming no net increase in energy use):

• Detached 1- and 2-family dwellings moved from one jurisdiction to another
  - Premanufactured homes delivered from the location of production for initial installation on a building site is not considered “moved”
Additions, Alterations, Renovations, and Repairs

Changes in occupancy or use (*Section 101.4.4*)
- Must comply if it would result in increased demand for fossil fuel or electrical energy

Change in space conditioning (*Section 101.4.5*)
- Non-conditioned spaces altered to become conditioned must comply

Example – garage turned into a bedroom
Fire Repair Example

As for any repair, the following must be brought up to code:

• Exposed, un-insulated cavities including walls, ceilings, and floors
• Any replacement fenestration (entire fenestration assemblies)
• Replacement of luminaries in a “space” if 50% or more are being replaced
• New HVAC ducts must comply
• HVAC equipment must meet Federal standards
• All applicable mandatory provisions must be met
Local Jurisdictional Authority

From the 2009 Michigan Residential Code:

• General duties and powers of the building official \((R104.1)\)
  
  - Allows local building officials to render interpretations of codes and to adopt policies and procedures
  
  - Must conform with the intent of the code
Local Jurisdictional Authority

From the 2009 Michigan Residential Code:

• Modifications (R104.10)
  – When practical difficulties of meeting the code arise, the building official can grant modifications
  – Individual cases only
  – Modification must conform with the intent of the code
Required Permits

From the 2009 Michigan Residential Code:

• Emergency repairs *(R105.2.1)*
  - Equipment replacement and repairs only
  - Permit application can be submitted within the next working business day

• Repairs *(R105.2.2)*
  - Not required for ordinary repairs, lamp replacements, or connection of approved portable electrical equipment to permanent receptacles
  - Ordinary repairs do NOT include additions, alterations, replacement, or relocation of plumbing, electrical, or mechanical items
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
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
Mandatory Provisions

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

Prescriptive

“Prescriptive Packages Approach”

Trade-off

“Trade-off Approach” (UA)

Performance

“Performance Approach”

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
Demonstrate Compliance

Prescriptive

R-values
402.1.1
or
U-factor Alternative
402.1.3

“UA” Alternative

Total Building UA
402.1.4

Simulated Performance
/software/

Simulated Performance Alternative
405

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

The following provisions must be 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)
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

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT\textsuperscript{a} U-FACTOR</th>
<th>CEILING R-Value</th>
<th>WOOD FRAME WALL R-VALUE</th>
<th>MASS WALL R-VALUE\textsuperscript{f}</th>
<th>FLOOR R-VALUE</th>
<th>BASEMENT\textsuperscript{b} WALL R-VALUE</th>
<th>SLAB \textsuperscript{c} R-VALUE AND DEPTH</th>
<th>CRAWL SPACE \textsuperscript{d} 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\textsuperscript{e}</td>
<td>13/17</td>
<td>30\textsuperscript{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\textsuperscript{e}</td>
<td>15/19</td>
<td>30\textsuperscript{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\textsuperscript{d}</td>
<td>15/19</td>
<td>10, 4ft</td>
<td>10/13</td>
</tr>
</tbody>
</table>

\textsuperscript{a} The fenestration U-factor column excludes skylights.

\textsuperscript{b} The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

\textsuperscript{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.

\textsuperscript{d} Or insulation sufficient to fill the framing cavity, R-19 minimum.

\textsuperscript{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.

\textsuperscript{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

<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 $^b$</th>
<th>Floor $U$-Factor</th>
<th>Basement Wall $U$-Factor $^d$</th>
<th>Crawl Space Wall $U$-Factor $^c$</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>
</tr>
<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>
</tr>
<tr>
<td>7</td>
<td>0.35</td>
<td>0.60</td>
<td>0.026</td>
<td>0.057</td>
<td>0.057</td>
<td>0.026</td>
<td>0.050</td>
<td>0.065</td>
</tr>
</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.

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From DELEG Construction Code Part 10 Michigan Uniform Energy Code

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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
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
Compliance Using REScheck

Training Module

School of Planning, Design & Construction

Michigan State University
East Lansing, Michigan
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 Case Study. U. S. DOE Building Energy Codes Program.
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
REScheck Web or Desktop Download

www.energycodes.gov  Date visited: 11/22/2010
REScheck Training

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 Education
- States that can use REScheck for Compliance
- Known problems in REScheck
- REScheck Product Archive
- 2009 IECC Residential Prescriptive Requirements

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

Date visited: 11/22/2010
Additions and Renovations

• In REScheck, model additions and renovations as a addition/alteration (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 2009 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.

REScheck Case Study. U. S. DOE Building Energy Codes Program.
**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 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.

REScheck Case Study. U. S. DOE Building Energy Codes Program.
Compliance Report

Generated by REScheck-Web Software

Compliance Certificate

Project Information and Passing Score Displayed

Inventory of Building Components
# Inspection Checklist

## 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: ____________

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**Checklist Allows Code Official to Verify Individual Building Components**
Energy Features Certificate

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:

Certificate Posted at Electrical Panel to Identify Primary Building Components

Name of Building Inspector and Date of Final Inspection
