Code Compliance via Tools and Resources

Getting Out of the Book and Into the Real World!
So much code, so little time.
So much code, so little time
So many options

ASHRAE 90.1

IECC Prescriptive
R-value
U, C, F-factor

Component Performance
Alternative

Performance
No energy for ENERGY

- Energy Code
  - Envelope
  - Mechanical SWH
  - Lighting
The design saturated condensing temperatures for air-cooled condensers shall not exceed the design dry-bulb temperature plus 10°F (5.6°C) for low-temperature refrigeration systems, and the design dry-bulb temperature plus 15°F (8°C) for medium-temperature refrigeration systems where the saturated condensing temperature for blend refrigerants shall be determined using the average of liquid and vapor temperatures as converted from the condenser drain pressure.

For operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid flow and 85°F (29°C) entering condenser water temperature, the evaporator fluid flow shall have maximum full-load kW/ton (FL) and part-load ratings requirements adjusted using Equations 4-6 and 4-7.

Equation 4-6

Equation 4-7

The weighted average U-value of all roof assemblies shall be based on the (UA Proposed) values for each skylight assembly.

The weighted average U-value of all roof assemblies is calculated as:

\[
U_{\text{roof}} = \frac{\sum (U_{\text{skylight}} \times A_{\text{skylight}})}{\sum A_{\text{skylight}}}
\]

Where:
- \(U_{\text{skylight}}\) is the skylight U-value as specified in Table C403.2.3(7).
- \(A_{\text{skylight}}\) is the skylight area.

The skylight area is less than or equal to the skylight area allowed by Section C402.4.1, the value of \(E\) (Excess Skylight Value) shall be zero. Otherwise:

\[
E = \left( \frac{S}{A_{\text{roof}}} \right) - (EA \cdot U_{\text{roof}}), \text{ but not less than zero.}
\]

Where:
- \(E\) is the excess skylight value adjusted for nonstandard conditions.
- \(S\) is the total skylight area.
- \(A_{\text{roof}}\) is the allowable skylight area as specified in Section C402.4.1.
- \(U_{\text{roof}}\) is the weighted average U-value of all roof assemblies.

The weighted average U-value of all roof assemblies is calculated as:

\[
U_{\text{roof}} = \frac{\sum (U_{\text{roof}} \times A_{\text{roof}})}{\sum A_{\text{roof}}}
\]

For opaque assemblies of the exterior wall:

The (UA Proposed) values for each opaque assembly of the exterior wall shall be determined in accordance with Equation 4-2 shall be permitted in lieu of compliance with the U-, F-, and C-factors in Tables C402.1.3 and C402.1.4. The total fenestration areas determined in accordance with Equation 4-2 shall be permitted in lieu of compliance with the U-, F-, and C-factors in Tables C402.1.3 and C402.1.4. The fenestration areas in Section C402.4.1.

For operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid flow and 85°F (29°C) entering condenser water temperature, the evaporator fluid flow shall have maximum full-load kW/ton (FL) and part-load ratings requirements adjusted using Equations 4-6 and 4-7.

Equation 4-6

Equation 4-7
What happens to a code book that you don’t understand?
Leaving us with efficiency on paper only

efficiency = \frac{\text{useful energy out}}{\text{total energy in}}
Don’t tell me what the code says...

Help me do my job!!!
We tell them that...

ENERGY CODES ARE
LIFE-SAFETY CODES
The Building Science Proves It!

SHAUNNA MOZINGO
THE MOZINGO CODE GROUP

CHRISTINE BRINKER
SOUTHWEST ENERGY EFFICIENCY PROJECT
Show Them...

THIS DIAGRAM HIGHLIGHTS THE PATHS OF FIRE PROPAGATION THROUGH IMPROPERLY SEALED WALL PENETRATIONS. COURTESY OF IFC
Don’t just tell them to build tight, show them why!!!

Look how houses have changed

1910

2010
Transport Mechanism

Air flow basics

- Air is a fluid – like water
- Two requirements for air flow
  - Hole or path
  - Driving force = pressure difference
Stack effect

- **B** additional warm air expands, increasing pressure and pushing household air out through cracks/gaps.
- **A** warm (less dense) air rises.
- **C** air leaving the house creates negative pressure in the cooler, lower levels - outdoor air is drawn in through any cracks or gaps.

**Note:** assumes calm conditions (no wind).
Vented Crawl Space

How we thought it worked

Moisture removed from house

Ventilation Air

Ventilated Crawl

Energy Logic, Inc
Vented Crawl Space

How it really works

Air moving out high side hole

Moisture transported into house &/or attic

Air moving through low side hole

Ventilated Crawl

Energy Logic, Inc
System Effect

Having supply and return air not equal or dominant leakage on the ducts

Sends basement negative
Bulk Water

- Finds path of least resistance
- Generally follows gravity
- Can be drawn upward or sideways
  - Capillary action
  - Best practice
Vapor Diffusion

- Moisture moving directly through a material
  - From More to Less
  - Vapor pressure pushes water at a microscopic level through a material

- Function of
  - Temperature
  - Relative humidity
Build Tight Ventilate Right
Moisture

One of the main reasons for producing an airtight building is to protect the structure against dampness originating from air leakages.

Photo: passivehousesystems.co.uk
compensation
Paths of compliance for Options - Commercial:

- Prescriptive
  - R-Value Method
  - U, C and F Factor Alternative
- Component Performance Alternative
- Performance
- Above Code

Make sure they know there are options!!
Options, People, Options!!!

Paths of Compliance Options - Residential

Prescriptive
- R-Value Method
- U-Factor Alternative
- Total UA Alternative

Simulated Performance Alternative

Energy Rating Index

Above Code Options
Did I mention OPTIONS?

C406 Additional Efficiency Packages

- 2012: 3 options
- 2015: 6 options
- 2018: 8 options, including envelope options
Show Them The Money$$
Then help them do their job!

<table>
<thead>
<tr>
<th>2009 IECC Section #</th>
<th>Mechanical Rough-in Inspection</th>
<th>Plans Verified Value</th>
<th>Field Verified Value</th>
<th>Compiles?</th>
<th>Comments</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>S03.2.2.3</td>
<td>HVAC equipment cooling efficiency verified</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S03.2.4.4</td>
<td>Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S03.2.5.1</td>
<td>Demand control ventilation provided for spaces &gt; 5000 ft2 and &gt;45 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow &gt; 3,000 cfm</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S03.3.1</td>
<td>Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S03.4.1</td>
<td>VAV fan motor &gt; 1.0 hp to be driven by variable speed drive, have a vane or fixed pitch blades, or have controls or devices to limit fan motor demand.</td>
<td>CVSD</td>
<td>CVSD</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S03.2.6</td>
<td>Exhaust air energy recovery on systems &gt; 3,500 cfm and 70% of design supply air.</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2009 IECC Section #</th>
<th>Rough-in Electrical Inspection</th>
<th>Compiles?</th>
<th>Comments</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>S05.2.2.2.2</td>
<td>Automatic lighting control to shut off all building lighting installed in buildings &gt; 5,000 ft2.</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S05.2.2.1</td>
<td>Lighting controls installed to uniformly reduce the lighting load by at least 50%.</td>
<td>% area in compliance</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

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## The Checklist

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td><strong>Project Information Sheet</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Plan Review/Permit #</strong></td>
<td><strong>Date</strong></td>
</tr>
<tr>
<td><strong>Project Address</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Project Contact Info</strong></td>
<td><strong>Name</strong></td>
</tr>
<tr>
<td></td>
<td><strong>email</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Phone</strong></td>
</tr>
<tr>
<td><strong>Building Type</strong></td>
<td></td>
</tr>
<tr>
<td>Retail/Mercantile</td>
<td>Office</td>
</tr>
<tr>
<td>Restaurant/Dining/Fast Food</td>
<td>Healthcare</td>
</tr>
<tr>
<td>Lodging/Hotel/Motel</td>
<td>Warehouse/Storage</td>
</tr>
<tr>
<td></td>
<td>High Rise Residential</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td><strong>New Construction</strong></td>
<td><strong>Addition</strong></td>
</tr>
<tr>
<td><strong>Renovation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Compliance Approach</strong></td>
<td></td>
</tr>
<tr>
<td>Prescriptive</td>
<td>UA Trade Off</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
</tr>
<tr>
<td>Glazing &lt; 40%</td>
<td>Compliance with IECC</td>
</tr>
<tr>
<td></td>
<td>Compliance w/ ASHRAE 90.1</td>
</tr>
<tr>
<td><strong>Plan Review Contact Info</strong></td>
<td><strong>Name</strong></td>
</tr>
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<td><strong>email</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Phone</strong></td>
</tr>
<tr>
<td><strong>Jurisdiction Name/Address</strong></td>
<td></td>
</tr>
<tr>
<td><strong>County</strong></td>
<td><strong>Climate Zone</strong></td>
</tr>
</tbody>
</table>

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Some Other Resources

Top Items for Energy Code Plan Review

Full Energy Code Checklist

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How do I fit Energy Code enforcement into my already busy routine?

Top 10 approaches

Implement one thing at a time...

Training on how to look at energy at the same time as everything else
This approach:
One small step for man...
HOW = IMPLEMENTATION PLANS

Town of Parker 8 Steps to Implementation

1. Early Code Training
2. Inclusive Training
3. Relate Energy Code to Building Science
4. Energy Ratings
5. Internal Champion
6. Phased Roll-Out
7. Field Inspection
8. Outreach
A foot in the door to full code compliance
## Table 6. Estimated Cost to Consumer of 2018 Code Compliance

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Code Change</th>
<th>2018 IRC Reference</th>
<th>2018 IRC Cost Range ($)</th>
<th>Other Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-8 (RB229)</td>
<td>Support for headers: revises table for minimum number of king studs; now only requires 1 or 2 for low-wind urban and suburban conditions.</td>
<td>Wall Construction R602.7.5</td>
<td>High: (493) Low: (516) High: 0 Low: 210</td>
<td>House opening less than 3 years</td>
</tr>
<tr>
<td>R-11 (RB303)</td>
<td>Masonry veneer: adds new provisions for brick tie attachment over foam sheathing and direct to 7/16” sheathing.</td>
<td>Wall Covering R703.8.4</td>
<td>N/R N/R N/R N/R High: 325 Low: (73)</td>
<td>House brick continues insulating</td>
</tr>
<tr>
<td>E-1 (RE31)</td>
<td>Reduces the maximum window U-factor requirement in Climate Zones 3-8.</td>
<td>Energy Efficiency N1102.1.2</td>
<td>N/A N/A High: 85 Low: 74</td>
<td>House Climate 3-8</td>
</tr>
<tr>
<td>E-6 (RE127)</td>
<td>Lighting efficiency: increases the percent of permanently installed lighting fixtures that must contain high-efficiency lamps from 75% to 90%.</td>
<td>Energy Efficiency N1104.1</td>
<td>High: 8 Low: 8</td>
<td>House Climate 3-8</td>
</tr>
<tr>
<td>M-1 (RM36)</td>
<td>Duct sealing: eliminates the requirement for sealing longitudinal seams of snap-lock and button-lock types of HVAC ducts located inside conditioned space.</td>
<td>Duct Systems M1601.4.1</td>
<td>High: 0 Low: 129</td>
<td>House metal ducts inside conditioned space</td>
</tr>
</tbody>
</table>

**Total to Consumer:** (485) (637) 93 (599) 70 (548) 70 (548)
Decoding the Code – AKA: Resources and Tools

Checklists
- Surveys of other jurisdictions – Code Edition and just questions

Webinars
- Various jurisdictions of different sizes and different climates

Common Amendment Packages
  - Implementation Plans

Code Adoption Assistance
  - Links to great sites (NAHB cost analysis, buildingscience.com, Buildingcodecollege.com)

Code Books and other books
  - MOU between Jurisdictions and Raters
  - Learning from each other!

How-to material

Mozingo Code Group LLC
Parting words:

Don’t tell me what the code says, tell me how to make it work; tell me how to use it! Help me understand WHY!