2016 Building Energy Efficiency Standards

2016 STAFF WORKSHOP ON DRAFT LANGUAGE
LOW RISE RESIDENTIAL
MANDATORY AND PRESCRIPTIVE REQUIREMENTS

Bruce A. Wilcox, PE
November 3, 2014
150.0 – MANDATORY FEATURES AND DEVICES

- Air Conditioner Filter Dryer

150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE

- Attics
- Ducts
- Walls

150.2 – ADDITIONS AND ALTERATIONS

- Exceptions
This Energy Commission Staff proposal is based heavily on the work of the California Statewide Codes and Standards Enhancement (CASE) Program that is funded, in part, by California utility customers under the auspices of the California Public Utilities Commission.

CASE Reports are posted on CEC’s rulemaking website:

In some instances, Staff’s proposal varies from the Statewide CASE Team proposed code changes.
Air Conditioner Filter Dryer

Air conditioner Liquid Line Filter Driers
Shall be installed if required by manufacturers specifications
Proposed Code Change for Attics and Ducts

2 Prescriptive Package Options in CZ 1, 2, 4, 8-16, based on Ducts and Duct Location

1. Ducts in a High Performance Vented Attic (HPA)
   • Roof Deck Insulation Options
   • R-38 Ceiling Insulation
   • Ducts: R-8 Insulation, Tested 5% Leakage

   OR

2. No Ducts or Air Handlers in any Attic (attic same as 2013)
   ❖ Ducts in Conditioned Space (DCS)
     • Locate ducts and air handler in conditioned space
     • HERS verification of no duct leakage to outside

   OR

   ❖ Ducts in Other Unconditioned Spaces
     • Locate ducts and/or air handler in basement or crawl space

   OR

   ❖ Ductless HVAC systems

Except Additions of 700 ft2 or less
Roof Deck Insulation Options

Continuous Insulation Above the Roof Rafters
- R6 for Roofing with Air Space (e.g. tile)
- R8 for Roofing with no Air Space (e.g. asphalt shingles)

OR

Below Deck Insulation at the Roof Rafters
- For Roofing with Air Space (e.g. tile) R13
- For Roofing with no Air Space R18
- No radiant barrier

And

Ceiling Insulation R38
1. **Ducts in a High Performance Vented Attic (HPA)**
   - R8 duct insulation
   - Tested 5% Leakage

2. **Other Ducts**
   - No change from 2013 requirements
Current Code Requirements

2013 Title 24 Requirements

Mandatory

- Duct leakage rate: 6% verified
- R-30 ceiling insulation

Prescriptive Requirements

- Ceiling insulation:
  - R-30 (CZ 2-10) or
  - R-38 (CZ 1,11-16)

- Duct insulation:
  - R-6 (CZ 1-10,12,13) or
  - R-8 (CZ 11, 14-16)
2013 Performance Approach

Standard Design Assumptions

- Ducts and equipment located in unconditioned space
  - 100% in attic for single-story
  - 65% in attic/35% in conditioned space for 2 or more stories

- Supply duct surface area is 27% of Conditioned Floor Area

- 1 to 300 attic ventilation
  - Higher with whole house fan
Current Code Requirements

2013 Performance Compliance Options

- Ducts located outside of the attic
- Roof deck insulation: above- and below-deck
- Low solar absorptivity cool roof
- Verified Low Leakage Air Handler and reduced duct leakage
- Increased duct insulation, buried ducts
- Verified duct design for reduced duct surface area
- Increased attic insulation, raised heel truss
Current Code Requirements

– 2012 IECC for comparison

Ceiling insulation: R-38 for most of CA
  Allows R-30 if insulation uncompressed at edges (i.e., raised heel truss)

Supply ducts insulation R-8 in attic

Duct sealing (Mandatory): Total leakage shall be ≤ 4 cfm25 per 100 s.f. CFA
  For a 2100 s.f. home with 3.5 ton system, matches 6% duct leakage requirement in Title 24

Air handlers shall have an air leakage of
  ≤ 2% of design air flow rate
Current CA standard practice

- Ducts and air handler in vented attic
- Insulation at the ceiling
- Measured duct leakage rate consistently less than 6%
- Duct insulation is a mix of R-4.2, R-6 and R-8
- No duct design, default area
High Performance Vented Attic Advantages

- Reduces attic temperature
- Incremental changes to standard practice
- No change to duct and air handler location
- Package of measures will provide similar savings to having ducts in conditioned space
## Present Value of Energy Savings

HPA package: R-13 Below Roof Deck, R-38 at Ceiling, R8 Ducts with 5% Leakage

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Note: A positive Life Cycle Savings means the measure is cost effective.
Above Deck Insulation

Product types

- Polystyrene: EPS (expanded) and XPS (extruded)
- Polyisocyanurate
- Polyurethane

Industry discussions

- Roof product fire rating
- Roof product attachment and ventilation
- Moisture management

Source: BSC 2011
Above deck foam board
Above Deck Insulated Tile
Below deck fiber insulation
Below deck spray foam insulation
Proposed Code Change for Walls

- Prescriptive U-factor 0.050 for exterior walls
  - Example: 2x6 with R19 cavity insulation and R6 sheathing
  - CZs 1-6 and 8-16
  - Applies to all low-rise residential buildings except:
    - For additions, extensions of existing wood framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 and R-19 for a 2x6 framing.
## Current Code Requirements

**Effective Code**

<table>
<thead>
<tr>
<th>Year</th>
<th>CA CZ 2-10</th>
<th>CA CZ 11-13</th>
<th>CA CZ 1, 14-16</th>
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<tr>
<td>2008</td>
<td>R-13</td>
<td>R-19</td>
<td>R-21</td>
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<td>2013</td>
<td><strong>Maximum U-factor: 0.065 (R-15+4 or R-13+5)</strong></td>
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<td>2013</td>
<td><strong>SIPs, ICFs, AWF, or other wall assemblies (i.e., 2x6 @ 24” o.c. etc.)</strong></td>
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**Note:** These climate zones are California specific.
Methodology for Savings Analysis

Energy and Life Cycle Costs

- CBECC-Res energy simulation

- Analysis using 2016 TDV

- Prototype buildings
  - Res: 2,700 SF (2-story) and 2,100 SF (1-story)
    - 55/45 weighting for applicability of prototypes statewide

- Baseline:
  - Minimally compliant with 2013 Prescriptive Requirements
    - (U: 0.065 aka 2x4” studs w/ R15 cavity + R4 continuous insulation, no QII)
### Incremental Cost Scenarios

<table>
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<tr>
<th>Stud</th>
<th>Cavity</th>
<th>Exterior</th>
<th>U-factor</th>
<th>Incremental Cost</th>
<th>IMC /s.f. wall area</th>
<th>Cavity Insulation Type</th>
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These scenarios all assume 16” O.C. framing
Present Value of Energy Savings

Prescriptive Wall Cost Effective in All Climate Zones except 7

Framing: 2x6 @ 16” o. c.
Cavity Insulation: R19 batt
Continuous Sheathing: R6
U-factor: 0.0480
Incremental Cost: $0.27/ft²-wall

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<tr>
<th>Climate Zone</th>
<th>Net Present Value</th>
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Proposed Prescriptive Standard Wall

U-factor of 0.050

- Climate Zones 1-6 and 8-16, all but San Diego coast (CZ 7)
- Cost effective using
  - 2x6 @ 16” OC, R19 + R6 (.048)
- Many other wood frame options:
  - 2x4 @ 16” OC, R15 + R8 (.050)
  - 2x6 @ 16” OC, R21 + R5 (.048)
  - 2x6 AWF R19 + R4 (.050)
Advanced Framing

Source: Building Science Corporation (2010)
Advanced Framing

Benefits:
- Reduces material costs
- Reduces labor (after learning curve)
- Reduces thermal bridging (lower framing factor)
- Dry wall clips can reduce drywall cracking

Challenges:
- Learning curve
- Additional upfront planning more important to reap full benefits

Additional Builder Resources:
- APA Construction Guide: Advanced Framing M400

Source: Building Science Corporation (2003)
Questions?