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Statewide Utilities C&S CASE Team Comments on the Draft 2016 Title 24 Res Compliance Manual

Attached are the Statewide Utility Codes and Standards Enhancement (CASE) Team's comments on the Draft 2016 Title 24 Residential Compliance Manual. The document is a collection of comments and suggested revisions developed by the CASE Team, the utility Title 24 compliance improvement team, and other subject matter experts who work with the compliance team that are familiar with the Compliance Manual and the implementation process for the Title 24 Standards. We hope the California Energy Commission will consider these revisions, many of which help clarify the intent of the Compliance Manual and the Standards.

Additional submitted attachment is included below.

CODES AND STANDARDS ENHANCEMENT INITIATIVE (CASE)

Comments on Draft Title 24 Residential Compliance Manual

2016 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS

California Utilities Statewide Codes and Standards Team July 31, 2015

This report was prepared by 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.

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1. PREFACE

The Codes and Standards Enhancement (CASE) initiative presents recommendations to support California Energy Commission's (CEC) efforts to update California's Building Energy Efficiency Standards (Title 24) to include new requirements or to upgrade existing requirements for various technologies. The four California Investor Owned Utilities (IOUs) – Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), Southern California Edison (SCE) and Southern California Gas Company (SoCalGas) – and Los Angeles Department of Water and Power (LADWP) sponsored this effort. The program goal is to prepare and submit proposals that will result in cost-effective enhancements to energy efficiency in buildings.

This document presents the Statewide CASE Team's comments on the Draft Residential Compliance Manual, which CEC posted for public review on July 2, 2015. Throughout this document suggested revisions to the manual are highlighted in blue; suggested additions are double underlined and suggested deletions are ~~struck with double lines~~.

2. COMMENTS ON CHAPTER 1 – INTRODUCTION

Page	Paragraph/Section	Suggested Revision	Comments
i			Update Table of Contents, page #'s aren't right
1-1	2	Chapter 3 addresses the requirements for the ~~design of the~~ building envelope.	Covers more than just design requirements
1-1	2	Chapter 8 covers the ~~computer~~ performance approach to compliance.	Can this be called just performance approach?
1-1	4	Readers should have a copy of the Standards to refer to while reading this manual as well as a copy of the 2016 Reference Appendices ~~which contain information that is common to both the residential and nonresidential standards.~~	Repeats with info just below.
1-2	6	Lighting subsections include high efficacy ~~and low efficacy~~ lighting, LED lighting, switching devices and controls, and recessed luminaires.	Low efficacy lighting was eliminated in 2016 Standards.
1-3	1	There are also design recommendations~~, such as on-site generation,~~ for which no compliance credit is offered.	Per 150.1(b)2 "...The energy budget for the Proposed Design Building is reduced if on-site renewable energy generation is installed, according to methods established by the Commission in the Residential ACM Reference Manual."
1-4	Section 1.3.6	While adding scrubbers to power plants and catalytic converters to cars reduce other emissions, they do not limit the carbon dioxide ~~we emit into the atmosphere~~ emitted into the atmosphere from energy used in buildings.	I think it was supposed to say that those activities don't affect the pollution emitted from buildings.
1-9	1&2	~~In multi-family buildings, lighting in common areas is subject to all nonresidential requirements if the common area CFA exceeds 20% of the building CFA. Where the~~	Suggest making Multifamily a (3) under A or a B for clarity.

Page	Paragraph/Section	Suggested Revision	Comments
		~~common area does not exceed 20% of the building CFA, lighting must meet mandatory requirements – a choice of high-efficacy lighting or automatic controls. See Standards § 150.0(k)12.~~ B. **Multifamily** In multifamily buildings, lighting in common areas is subject to all nonresidential requirements if the common area CFA exceeds 20% of the building CFA. Where the common area does not exceed 20% of the building CFA, lighting must meet mandatory requirements – a choice of high-efficacy lighting or automatic controls. See Standards § 150.0(k)12.	The three-story designation relates to multifamily buildings, since all single family homes fall under the low-rise residential requirements regardless of the number of stories. An apartment building with three or fewer habitable stories falls under the low-rise residential standards while an apartment building that has more than three habitable stories falls under the nonresidential standards. High-rise residential dwelling units must still comply with the lighting and water heating requirements for low-rise residential buildings.
1-11	3	1.5.3 Building Orientation	Energy Code Ace could supply graphic to visually illustrate orientation
1-15	1	1.5.4 Historic Buildings	Energy Code Ace could supply graphic to visually illustrate orientation
1-20	Example 1-7	Question A 2,100 ft² manager's residence is being constructed as part of a new 14,000 ft^2 conditioned warehouse building. Which Standards apply?	Deleted a part of the question that needs to remain.
1-23	3	New for the 2016 Building Energy Efficiency Standards are mandatory measures that require higher insulation values for the building envelope, better duct sealing to limit air leakage, and high efficacy lighting~~ to meet~~	Take out the reference to ASHRAE 62.2

Page	Paragraph/Section	Suggested Revision	Comments
		~~the requirements of ASHRAE Standard 62.2~~.	
1-23	4	Package A establishes the stringency of the Standards for the performance approach. ~~Approved computer programs model a house with the features of Package A to determine the envelope, space conditioning, and water heating budgets.~~	No need to talk about Energy Budgets and computer programs when describing the prescriptive approach.
1-24	2	~~The Package A prescriptive requirements serve as the basis of the standard design in the performance approach and determine the energy budget of a proposed design.~~ These prescriptive requirements require that ducted split system and packaged air conditioners or heat pumps (for definition see Reference Joint Appendix JA1) HERS tested be diagnostically tested to verify that they have the correct refrigerant charge.	No need to mention prescriptive energy budget when not discussing performance approach.
1-30	4	Energy Code Ace~~, http://energycodeace.com/,~~ offers free tools, training, and resources to help identify the compliance documents, installation techniques, and standards relevant to building projects in California. The Ace resources provide Fact Sheets, Trigger Sheets and Checklists to help understand when Title 24, Part 6 is "triggered" and how to correctly comply when it is. The program is administered by Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Gas Company and Southern California Edison. It is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission. http://energycodeace.com	Include auspices statement regarding Energy Code Ace. Format website consistent with other resources in this section.

3. COMMENTS ON CHAPTER 2 – COMPLIANCE AND ENFORCEMENT

Page	Paragraph/Section	Suggested Revision	Comments
2-1	1	Before a permit is issued, the local enforcement agency examines the plans and specifications for the proposed building to verify compliance with all applicable codes and standards.	Technically this may not be true in many alteration cases: CEC should add info about counter-issued permits.
2-1	2	Once construction starts, the enforcement process begins for the Inspector who will verify that the installed building components (HVAC equipment, fenestration, lighting, insulation, etc.) match the energy components ~~modeled~~ documented on the Certificate of Compliance (CF1R) during each respective phase…	The term "modeled" is used in a different context for projects following prescriptive path.
2-1	2	If the enforcement agency's final inspection determines that the building conforms to the plans and specifications approved during plan check, ~~which includes~~ that all applicable Certificates of Installation (CF2R) and Certificates of Verification (CF3R) forms are registered and submitted for verification, and that it complies with all applicable codes and standards, then the enforcement agency may approve the ~~building~~ final the building permit.	CF2R and CF3R forms are not approved during plan check.
2-2	1	~~*Registration*~~ Compliance document~~ation~~ *registration* is required for the construction and alteration of residential buildings for which HERS verification is required for compliance.	Specify that the compliance documentation is what needs to be registered.
2-3	3		CEC determined that ALT forms are not needed for all permit types. A separate section needs to be developed to address counter issues permits (window changeouts, re-roofs, water heater changeouts and HVAC changeouts)

Page	Paragraph/Section	Suggested Revision	Comments
2-3	3	Prescriptive ~~V~~versions of the Certificate of Compliance (CF1R) have been designed to be used specifically with: Residential Newly ~~Construction~~ Constructed Buildings (CF1R-NCB-01), Residential Additions (CF1R-ADD-01), Residential Alterations (CF1R-ALT-01), Residential HVAC Change-outs (CF1R-ALT-~~HVAC~~02) Solar (CF1R-SRA-01)	Specify the form name & specify that these are prescriptive forms. If listing the solar ready form under CF2R, should be consistent and list under CF1R too..
2-3	3	The Certificate of Installation (CF-2R) is separated into: 1. Envelope (CF2R-ENV), 2. Lighting (CF2R-LTG), and 3. Mechanical (CF2R-M~~E~~CH)	Update to MCH to match form names.
2-4	1	§10-103 of the Building Energy Efficiency Standards allows the registered CF1R-ALT-~~HVAC~~02 form to be submitted to an enforcement agency at final inspection, and not before obtaining a permit.	Update form name.
2-11	1	~~Prescriptive Package A, as well as most performance method software applications,~~There are mandatory measures, prescriptive measures and performance credits that require ~~some sort of~~HERS field verification and/or diagnostic testing. Most of the typical measures that require HERS field verification and/or diagnostic testing…	Communicate there are mandatory measures with HERS requirements in addition to prescriptive and performance.
2-14	Table 2-1	CF1R-ALT-01-E, Certificate of Compliance (Alterations) CF1R-ALT-02-E (~~Alterations,~~ HVAC changeouts) CF1R-STH-~~02~~01-E, Worksheet for OG 300 solar water heating systems ~~FC-1, Fenestration Certificate for unrated NFRC windows~~	Add CF1R-ALT-01 to this table. Specify the ALT-02 is for HVAC changeouts. Listed STH-02 for OG 300. Does FC-1 still exist? Where is this form?
2-15	1	~~Thermal Mass Worksheet (WS1R), the~~ Area Weighted Average Calculation Worksheet (~~WS2R~~CF1R-ENV-02-E)), the Solar Heat Gain Coefficient (SHGC) Worksheet	Worksheet names need to be updated. The following sentence seems

Page	Paragraph/Section	Suggested Revision	Comments
		(~~WS3R~~CF1R-ENV-03-E), the Cool Roof and SRI Worksheet (CF1R-ENV-04-E) and the ~~Solar Water Heating Calculation Form (CFSR)~~.Solar Worksheets (CF1R-SRA-02-E, CF1R-STH-01-E and CF1R-STH-02-E). Blank copies of these documents are included in Appendix A of this manual for use with the prescriptive compliance requirements. When the performance approach is used~~, these worksheet documents are not needed~~only the CF1R-STH worksheets are needed since the Energy Commission-approved software performs the calculations and provides the necessary documentation ~~as part of the software output~~contained in all other worksheets	redundant since the previous sentence states that performance projects do not need to use worksheets: "However, when the performance approach is used, only the CF1R forms are required on the building plans." We suggest deleting the sentence.
2-15	5	a CF1R-ADD form is required to be submitted for additions; a CF1R-ALT-01 form is required for alterations; and a CF1R-ALT-02 form is required for HVAC change outs.	Update ALT form names.
2-16	1	The Certificate(s) of Installation (CF2R) are separated into Envelope (CF2R-ENV), Lighting (CF2R-LTG), and Mechanical (CF2R-MCH),	Update to MCH.
2-24	2	For a list of qualified documentation authors, visit the California Association of Building Energy Consultants' (CABEC) website at: ~~http://www.cabec.org/ceperosterall.php~~ www.cabec.org	This should be the www.cabec.org home page as the CEPE program is merging into a CEA program and the roster location will likely move.
2-26	4	When the Standards require document registration, the Certificate of Compliance documentation that is submitted to plan check must be a registered document from an approved HERS provider data registry. There is one exception to the requirement that the Certificate of Compliance must be registered at the time of plan check, and that is for the CF1R-ALT-02-E form used for HVAC changeouts. If approved by the permitting jurisdiction, permit applicants may use unregistered CF1R-ALT-03-E or CF1R-ALT-04-E forms (dependent upon climate zone) to apply for permits, and present the registered	Note exception for HVAC change-outs.

Page	Paragraph/Section	Suggested Revision	Comments
		CF1R-ALT-02-E form to the inspector at time of permit final.	
2-34	Example 2-7	~~These~~ HERS providers are required to provide ongoing monitoring of the propriety and accuracy of HERS raters in the performance of their duties and to respond to complaints about HERS rater performance.	Previous sentence listing HERS Providers was edited out.
2-38	1	Field verification and diagnostic testing is only required when certain regulated efficiency measures or equipment features are installed. If such efficiency measures or equipment features are not installed, then field verification and diagnostic testing is not required. For example, if a dwelling that must comply with the Standards does not have air distribution ducts, then HERS verification of duct leakage is not required for compliance.	Suggest moving this paragraph right under the 2.5.1 heading and before the list of HERS measures.
2-38	List of HERS measures	x) Verified Parallel Piping y) Central Fan Integrated Ventilation Cooling systems z) Zonal Controls	Add Central Fan Integrated Ventilation Cooling systems and Zonal Controls to the list. Specify which HERS measures in the list are mandatory vs. prescriptive vs. performance.

4. COMMENTS ON CHAPTER 3 – BUILDING ENVELOPE

Page	Paragraph/Section	Suggested Revision	Comments
3-1	Section 3.1	…for low-rise residential buildings…	Does not cover high-rise multi-family residential buildings.
3-1	Section 3.1	…dominated by solar gains through windows, skylights, and roof/attic assemblies.	Heat gain through the roof can have a larger effect than through windows and skylights in some designs.
3-2	Section 3.3	§10-109 of the Standards allows for the introduction	Without "of the Standards," readers might think 10-109 refers to the PRC.
3-3	Section 3.3.1.1	…a U-factor no greater than 0.043.	"at least" would mean you want a larger U-factor.
3-5	Section 3.4 B.	An indirectly conditioned space has less thermal conductance to a directly conditioned space than to the outside.	An indirectly conditioned space has **greater** thermal resistance to a directly conditioned space than the outside.
3-5	Section 3.4 C.	…as there is less thermal conductance to the directly conditioned space below than to the ambient air outside.	An indirectly conditioned space has **greater** thermal resistance to a directly conditioned space than the outside.
3-7	Section 3.4 I.	I. Fenestration or Windows are considered part of ~~the~~ an exterior wall because the slope is typically over 60°. Where the slope of fenestration is less than 60°, the glazing indicated as a window is considered a skylight.	Line up lettering with Fenestration paragraph.
3-7	Section 3.4 I.	~~A vapor retarder or barrier is a special covering over framing and insulation or covering the ground of a crawl space that~~	Redundancy of 3.4 H.

Page	Paragraph/Section	Suggested Revision	Comments
		~~protects the assembly components from possible damage due to moisture condensation. During cold weather, the inside of the house is warm and moist (from breathing, showers, etc.) and the outside is cold and dry. Moisture moves from more to less and from warm to cold. When the moisture (in vapor form) reaches a point in the wall or roof assembly that has a temperature below the dew point, it will condense into liquid water. Water build up can cause structural damage, create mold that may contribute to indoor air quality problems and can cause the insulation to lose its effectiveness.~~	
3-8	Section 3.4 I Last paragraph	A low-sloped roof is defined as a surface with a pitch less than or equal to 2:12 (9.5 degrees from the horizon), while a steep-sloped roof is a surface with a pitch greater than 2:12~~ (9.5 degrees from the horizon)~~.	Second use of 9.5 degrees is redundant.
3-8	Section 3.4 I. Last paragraph	…heat gain is based partially on the sun's angle…	There is a lot more to it than that: reflectivity, absorptivity, emittance, etc.
3-11	3.4 M. Last paragraph	…as an energy benefit to the occupants.	"Homeowner" covers a very small segment of residential occupants.
3-11	3.5 Paragraph 1	Fenestration accounts for a large impact on heating and cooling loads of residential ~~and high-rise residential~~ space conditioning loads.	Clarify by using either "low-rise residential and high-rise residential" or just "residential"
3-11	3.5 Paragraph 1	…but can affect the ~~load~~ operation of…	Load operation is not a common term.
3-11	3.5.1 Paragraph 1	… identify ~~a rating, or~~which is ~~a measurement scale that is reflective of a~~the thermal resistance (U-factor) and solar heat gain coefficient, which are factors that affect a window's energy performance.	As an alternative, you could make the word "rating" a plural, but this fix is less informative than the one suggested.
3-12	3.5.1 B.	**The Solar Heat Gain Coefficient**	Clarify what

Page	Paragraph/Section	Suggested Revision	Comments
	Paragraph 1	**(SHGC)** measures the percentage of ~~heat in~~ radiant heat that… OR **The Solar Heat Gain Coefficient (SHGC)** measures the percentage of heat in the sun's radiant ~~heat~~energy that…	"percentage of heat in radiant heat" means.
3-12	3.5.1 B.	…amount of heat that comes in from the outside. For passive solar designs, a high SHGC is desirable with good orientation and overhangs that block the summer sun."	As we move toward ZNE, we need to encourage good passive solar design to minimize the need for heat as well as minimizing the need for AC.
3-12	3.5.1 D Paragraph 1	By putting the air leakage number on the label, the manufacturer is stating that the product meets the minimum pass/fail level established by the NFRC.	Without this qualifier, the text is misleading as an explanation of what is on the NFRC label. Consumers will not find AL numbers higher **OR** lower than 0.2. The explanation that 0.2 is a "passing" score for air leakage; no other AL numbers are reported on the NFRC label, so it is not a "rating" in the same sense as U-factor, SHGC, or VT.
3-12	3.5.1 Paragraph 6	There are five primary categories of fenestration: … D. Curtain Walls E. Storefront Glazing	The "five primary categories" list excludes curtain walls and store front glazing, both of which are common in new urban multifamily construction - one form of low-rise residential. We suggest adding them to the list.
3-13	Paragraph 3 Number 2	…assembled on site (such as knocked down products, sunspace kits, and curtain walls unless they are not provided with an NFRC label).	Without this qualifier, the text is in direct conflict with the previous paragraph.

Page	Paragraph/Section	Suggested Revision	Comments
3-13	Paragraph 3 Number 4	…change its performance properties, including ~~U-factor~~, Solar Heat Gain Coefficient (SHGC),	This might be true for a very small number of products, but saying it here is more likely to confuse than illuminate. Most dynamic glazing is designed to change SHGC and VT, but not U-factor (other than incidentally and very marginally).
3-15	3.5.3.1 Paragraph 4	~~Note: In the case when unrated NFRC site-built fenestration is used in a residential application, there is an alternative procedure to calculate the default thermal efficiencies U-factor and SHGC values of such products. Using this alternative may not result in meeting the prescriptive values as listed in §Table 150.1-A. However, it may be used in the Performance Approach. The alternative calculation can be found in the Reference Nonresidential Appendices NA6.~~	The section is about air leakage, but the note is about calculating U-factor and SHGC for site-built products.
3-16	3.5.3.2 Last paragraph	Table 110.6-A and Table 110.6-B in the Energy Standards list the ~~worst~~ best ~~performing~~ values that can be assumed when fenestration is not rated by NFRC.	It is not okay to assume values better than those in the tables when not using NFRC, so these are best values that can be assumed. It is better to state that the values listed in the Standards are the best assumed values in the absence of NRDC rated values.
3-24	First paragraph	~~Answer~~ ~~First, all windows must meet the mandatory requirements of §110.6 and §110.7 unless exempted.~~ ~~For field-fabricated windows, you must select U-factors and SHGC values from the default tables (TABLE 110.6-A and TABLE 110.6-B from the Standards). Windows that are not field-fabricated must be labeled with an NFRC certified or~~	The answer to Example 3-4 appears twice.

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		~~default efficiencies. If the U-factors or SHGC values do not comply with the prescriptive requirements, the performance method must be used. To simplify data entry into the compliance software, you may choose the U-factor from TABLE 110.6-A that is the highest of any of the windows planned to be installed, and use this for all windows for compliance purposes. However, you must use the appropriate SHGC from TABLE 110.6-B for each individual window type being installed.~~	
3-29	Section 3.5.3.4	Table 3-2 is misplaced and should be moved to below the 3.5.4 section heading.	The section is about mandatory maximum U-factors and SHGCs but the table is about prescriptive requirements.
3-30	Section 3.5.5 A	…where glazed door and TDD areas ~~is~~ are included in the maximum of 20% fenestration area. However, the U-factor shall not exceed a maximum ~~is~~of 0.58. See §150.0(q) and Exception 1 of §150.1(c)3A.	Clarify language & fix typo.
3-32	3.5.6 B	glass panes that can be opened and closed ~~manually~~ or using automatic controls OR change the definition of dynamic glazing in section 3.5.5 C. (Same issue arises in 3.5.6 C)	3.5.5 C says it must be automatically controlled, while 3.5.6 B says it can be automatic or manual. Section 150.1 c.3 A says it must be controlled automatically.
3-34	Last	• Window films must have at least a ten-year warranty.	This 10 year warranty requirement is not in the Standards and may be unenforceable. It could be added to the window film definition in the Standards (Section 100.1, page 41) if the CEC makes a set of minor "clean-up" changes. CEC should check this bullet with

Page	Paragraph/Section	Suggested Revision	Comments
			legal counsel.
3-37	3.5.7 D	"If the door ~~is made up of~~ has less than 50% glazing, the opaque part of the door is ignored in the prescriptive approach, but in the performance method it is assumed to have a default U-factor of 0.50.	Clarify the sentence.
3-39	1	In air conditioning climates, choosing a window with an SHGC lower than 0.25 will reduce the cooling loads compared to the standard design.	0.25 or 0.32 from package A?
3-42	2	$SHGC_{combined} = (0.2875 \times SHGC_{max} + 0.75) \times SHGC_{min}$	SHGCmax and SHGCmin are not defined or clear. Provide definitions.
3-44	3.5.8.9	"This mandatory measure is discussed in greater detail in Section 3.6.1.17 and 3.6.1.18."	There is not much information about what to do to meet the ventilation requirements in those sections - just a repeat of the requirements.
3-46	3.6.1.1.2	Openings for plumbing, electricity, and gas lines in exterior and interior walls, ceilings and floors;	Particularly in multi-family buildings, this is as important for interior walls as exterior walls.
3-52	3	Field Applied Coatings	Is this section needed for residential? It makes sense to talk about tile and shingle options for single-family.
3-63	3.6.1.9	Some areas of the roof/ceiling can be ~~less~~greater than the mandatory ~~minimum~~ maximum U-factor as long as other areas ~~exceed~~ have a lower U-factor than the requirement and the weighted average U-factor for the overall ceiling/roof is 0.043 or less.	U-factors are maximums, not minimums.
3-64	1	l~~i~~nsulation must be blown in evenly,	Fix typo.

Page	Paragraph/Section	Suggested Revision	Comments
3-65	3.6.1.12 Paragraph 2	In all cases, some areas of the floor can have a U-factor ~~less~~ greater than the requirement as long as other areas have a U-factor that ~~exceeds~~ is lower than the requirement and the area-weighted average U-factor is less than that described above	U-factors are maximums, not minimums.
3-65	3.6.1.12 Paragraph 5	When a controlled ventilated crawlspace or an unvented crawlspace is used, raised-floor insulation is not required, although the foundation walls must be insulated and vapor retarder is required over the ground.	This is an important clarification for anyone considering an unvented or controlled vent crawlspace.
3-67	1	Delete Example 3-14	Duplicate of Example 3-18, which has a more detailed answer.
3-69	3.6.1.15 Last paragraph	"For all types of vapor retarders ~~barriers~~, care should be taken…"	A "vapor barrier" has a perm rating of 0.01 or less. Since the section above this statement refers to Class I and Class II vapor retarders, this sentence should too.
3-71	3.6.1.16	"1. They must be listed as defined in the Article 100 of the California Electric Code for zero clearance insulation contact (IC) by Underwriters Laboratories or other testing/rating laboratories recognized by the International Code Council (ICC)~~Conference of Building Officials~~"	ICBO merged with the two other code councils to form ICC. It is worth noting that the Standards only say a "nationally recognized testing/rating laboratory." They do not say it has to be recognized by the code council.
3-72	Example 3-19	Delete example 3-19.	This example tells how much ventilation reduction to count when there are louvers over a window, while the text above says that you cannot count an operable window for ventilation.

Page	Paragraph/Section	Suggested Revision	Comments
3-74	Table 3-17	Add indication for requirements for CZ 1-3 and 5-7.	Table 3-17 Checklists for Prescriptive Requirements for HPVA/DCS – this lists three options (A, B, C) but the headings suggest they only apply to CZ 4 and 8-16. Some of these requirements (attic insulation) apply to the other climate zones as well, but this is not made clear.
3-75	1	Option A requires insulation above the roof rafters, directly in contact with the roof deck, while Option B requires insulation installed between the roof rafters. The insulation values are different depending on whether or not there is an air gap present between the roofing materials and the roof deck.	Changed wording for clarification and to match the 15 day language. CEC clarified requirements for Option A to be based on where continuous insulation is above roof rafters even if it is below roof deck (e.g. a half-SIPS roof). This is in line with the CASE analysis and proposed requirements.
3-77	Figure 3-19	When installing asphalt shingles with roof deck insulation, it is best practice to implement a ventilation method between the roofing product and the top sheathing or insulation, as shown in ~~Figure 3-19 and~~ Figure 3-20, to prevent the roofing material from experiencing high temperatures.	Figure 3-19 does NOT show any ventilation between the insulation or roof sheathing and the roofing product. Also, in the figure, the roof sheathing is mislabeled as "above roof deck insulation."
3-80	2nd to last	Proper attic ventilation occurs at two points at the roof: the soffit (or eave) vents and the ridge or eyebrow vents. Ridge or eyebrow venting must be maintained when installing above deck insulation as shown in Figure 3-29?.	Ridge venting is not the only way to get high/low venting, but the text makes it sound like it is. There does not appear to be any figure that shows what this purports to show.

Page	Paragraph/Section	Suggested Revision	Comments
			Figure 3-19 sort of shows it, but is for eyebrow vents, not ridge vents.
3-80	Last	Add explanation under "Addressing Fire Performance of Roof Assemblies with Above Deck Insulation,"	Compliance Manual should explain what the heading signifies before going to a Q&A.
3-82	1 & 2	Insulation must be in direct contact with the roof deck and a plastic membrane or netting can be used to secure insulation. Proper attic ventilation must always be maintained to prevent the potential for moisture to condense. ... See Figure 3-24~~Figure 9Figure 84~~ – through Figure 3-27 for depictions of insulation options and maintaining proper ventilation.	The depiction in Figure 3-26 shows two things that contradict the previous paragraph. Fig 3-26 shows the insulation below the rafters instead of "in direct contact with the roof deck." Even if it were redrawn to show the insulation to be between the rafters, the baffles shown would prevent the insulation from being in contact with the roof deck.
3-85	Example 3-25	A new construction project in climate zone 12, with HVAC equipment and ducts in the attic, was designed to meet… …at least for the first few projects until the entire team is aware of the design needs. Side Note: If the design was changed so that roof deck has a radiant barrier and the HVAC equipment and ducts are verified to be in conditioned space, the altered design will meet the prescriptive requirements under Option C.	Option C in Table 150.1-A allows this.
3-85	Option C 1	Option C allows a project to place and verify that ducts are located in condition space instead of installing insulation at the roof deck. ~~This prescriptively applies to climate zones 4, 8-16.~~	There is nothing in 150.1(c)1A, or in Table 150.1A that indicates Option C only applies to CZs 4 and 8-16.
3-85	4	"Design strategies that cannot be used to	It's not clear why these

Page	Paragraph/Section	Suggested Revision	Comments
		prescriptively comply with Option C include are placing ducts and equipment in sealed (unvented) attics or in conditioned crawlspace. However, these methods are effective under the Performance Approach. See Section 3.6.3 for more information on advanced assemblies."	strategies are not allowed prescriptively.
3-86	1	Option C allows a project to place and verify that ducts are located in conditioned space instead of installing insulation at the roof deck. ~~This prescriptively applies to climate zones 4, 8-16.~~	There is nothing in 150.1(c)1A, or in Table 150.1-A that indicates Option C only applies to CZs 4 and 8-16.
3-86	All	"3. Duct and Air Handlers Located in Conditioned Space (Option C): Option C allows a project to place and verify that ducts are located in conditioned space instead of installing insulation at the roof deck. This prescriptively applies to climate zones 4, 8-16. If complying with this path, ceiling and duct insulation must be installed at the values specified in §Table 150.1-A for Option C, and a radiant barrier is also required in some climate zones. Simply locating ducts in conditioned space does not qualify for this requirement; a HERS rater must test and verify the system Design strategies that can be used to prescriptively comply with Option C include dropped ceilings (dropped soffit), plenum or scissor truss to create a conditioned plenum box, and open-web floor truss. The key is that the ducts and equipment are placed within the building's air barrier. See Section 4.4.2 for detailed information on DCS strategies. Design strategies that cannot be used to prescriptively comply with Option C are placing ducts and equipment in sealed (unvented) attics or in conditioned crawlspace. However, these methods are effective under the Performance Approach. See Section 3.6.3 for more information on advanced assemblies."	This information is the same as #3. on page 3-86. We suggest removing this text box and leaving info on page 3-86.

Page	Paragraph/Section	Suggested Revision	Comments
3-87	2	"Ceiling insulation may be tapered near the eave, but it must be applied at a rate to cover the entire ceiling at the specified level."	If it may be tapered, then must the insulation depth be greater than required at the center? Or is some tapering allowed? This isn't clear.
3-88	D	For projects using the prescriptive compliance path, an ~~An~~ alternative to the aged solar reflectance and thermal emittance is to use the Solar Reflectance Index (SRI) to show compliance.	Clarify that SRI is only used to comply prescriptively.
3-88	Last	By using the SRI calculator a cool roof may comply with an emittance lower than 0.75 ~~0.85~~, as long as the aged reflectance is higher and vice versa.	The requirement is 0.75, not 0.85.
3-89	1	For steep-sloped applications in climate zones 10-15, the three year aged solar reflectance ~~requirement~~ minimum of 0.20 and a (three year aged or initial) thermal emittance ~~requirement~~ minimum of 0.75, or	"requirement" does not tell the reader whether it is a max or a min.
3-92	3.6.2.2 A1.	The Package A prescriptive requirements (§Standards Table 150.1-A) call for a U-factor of 0.065 051 in climate zones 1-5 and 8~~-15~~16, and	Forgot CZ16.
3-93	Fig 3-31	Add text referencing Figure 3-31.	Explain the purpose of Figure -31. It does not appear to illustrate anything discussed in the text.
3-94	2	When the prescriptive ~~requirements~~ compliance approach ~~are~~ is used, the insulation must be installed integral with or on the exterior or interior of the mass wall.	Clarification
3-101	Fig 3-35	The illustration in the lower right quadrant should have the insulation under the slab, not on top of it.	Radiant floors do not work if the insulation separates the mass from the living space.
3-102	3.6.3.1 A	In an unvented attic (conditioned attic)	Clarify for consistency

Page	Paragraph/Section	Suggested Revision	Comments
		assembly insulation is applied directly at the roofline of the building, either above or below the structural roof sheathing. The roof system becomes part of the insulated building enclosure. For this case, the thermal boundary of the building results in a ~~n un~~conditioned attic space between the ceiling gypboard and the insulated roof above.	
3-103	Figure 3-36	Delete Figure 3-36.	It shows insulation at the ceiling level as well as at the roof deck. The figure does not illustrate anything mentioned in the undeleted text and contradicts the preceding text.
3-108	3.6.3.1-C: Figure 3-40	Figure 3-40 Raised Heel Truss (Energy Truss) Source: ~~Building America Solutions Center~~ Georgia Department of Community Affairs	Incorrect source is currently cited. Although retrieved from DOE Building America Solutions Center, original source of images is GA Dept. of Community Affairs.
3-125	4	There are ~~five~~ six basic types of insulation	Straw bales is an increasingly popular type of residential insulation, and bears mentioning here so that it is clear that it is acceptable. The CEC has established an R-value of 30 for straw bale walls (circa 1997).
3-126	4	Loose fill cellulose (shown in Figure 3-46) is ~~basically~~ usually paper that	Loose fill cellulose as a category also includes cotton.
3-129	Figure 3-47	Figure 3-47 – Properly Installed Rigid Insulation with Flashing Source: ~~2015 International Residential Code~~ *U.S. Environmental Protection Agency*	Incorrect source is currently cited.

Page	Paragraph/Section	Suggested Revision	Comments
3-137	3.6.3.4	~~B~~C. Structural Bracing, Tie-Downs, Steel Structural Framing	There are 2 sections labeled "3.6.3.4.B". Will need to edit subsequent section headers as well.
3-137	3.6.3.4 B (the 2nd "B") Last paragraph	"To take advantage of the QII energy credit, two primary installation criteria must be adhered to and they both must be field verified by a HERS rater:"	Nothing follows the colon. Was there supposed to be a list?
3-140	E	The board can be sheet metal, plywood, cement or oriented strand board (OSB) and the foam ~~is either~~ can be expanded polystyrene foam (EPS), extruded polystyrene foam (XPS) ~~or,~~ polyurethane or polyisocyanurate (polyiso) foam.	Rigid Polyisocyanurate (polyiso) foam is often used as well.
3-140	E	U-factors used for compliance must be taken from these tables~~, through the EZ-Frame assembly calculator,~~ or by using approved performance compliance software.	I don't think EZFrame is equipped to handle this construction assembly, nor should it be necessary with the listings in JA4. Does the EZ frame calculator still exist?
3-145	3.6.3.4 I Paragraph 1	The nature of straw bale construction provides an effective air barrier. For purposes of compliance, infiltration is assumed to be equivalent to framed walls.	In the discussion of every other wall type, there is mention of air leakage.
3-167	3.8.2.A	Center of Glass. ~~The~~ U-factor, SHGC and VT are measured only through glass…	This small change helps avoid confusion about labeled U-factor, SHGC, and VT, which are not measured only through glass.
3-170	3.8.2.W	Tinted. Darker gray, brown or green visible tint. Also, a low-e or IG unit with a VT ~~an SHGC~~ less than 0.5.	A lower SHGC does not make a window tinted. Tinted windows have lower VT, not SHGC.
3-173	1	Dynamic glazing definition: Includes active materials (e.g. electrochromic) and passive materials (e.g. photochromic and thermochromic) permanently integrated	Minor edits to definition.

Page	Paragraph/Section	Suggested Revision	Comments
		into the glazing assembly. Electro-chromatic glass ~~that~~ darkens by demand or lightens up when more free daylight or solar heat is desired. Improved ~~glasses~~ glazing decreases the Solar Heat Gain Coefficient (SHGC) in the summer and reduces heat loss in the winter and are glazing systems that have the ability to reversibly change their performance properties, including U-factor, Solar Heat Gain Coefficient (SHGC), and/or Visible Transmittance (VT) between well-defined end points.	How does dynamic glazing reduce heat loss in the winter?

Section 3.6.3.1

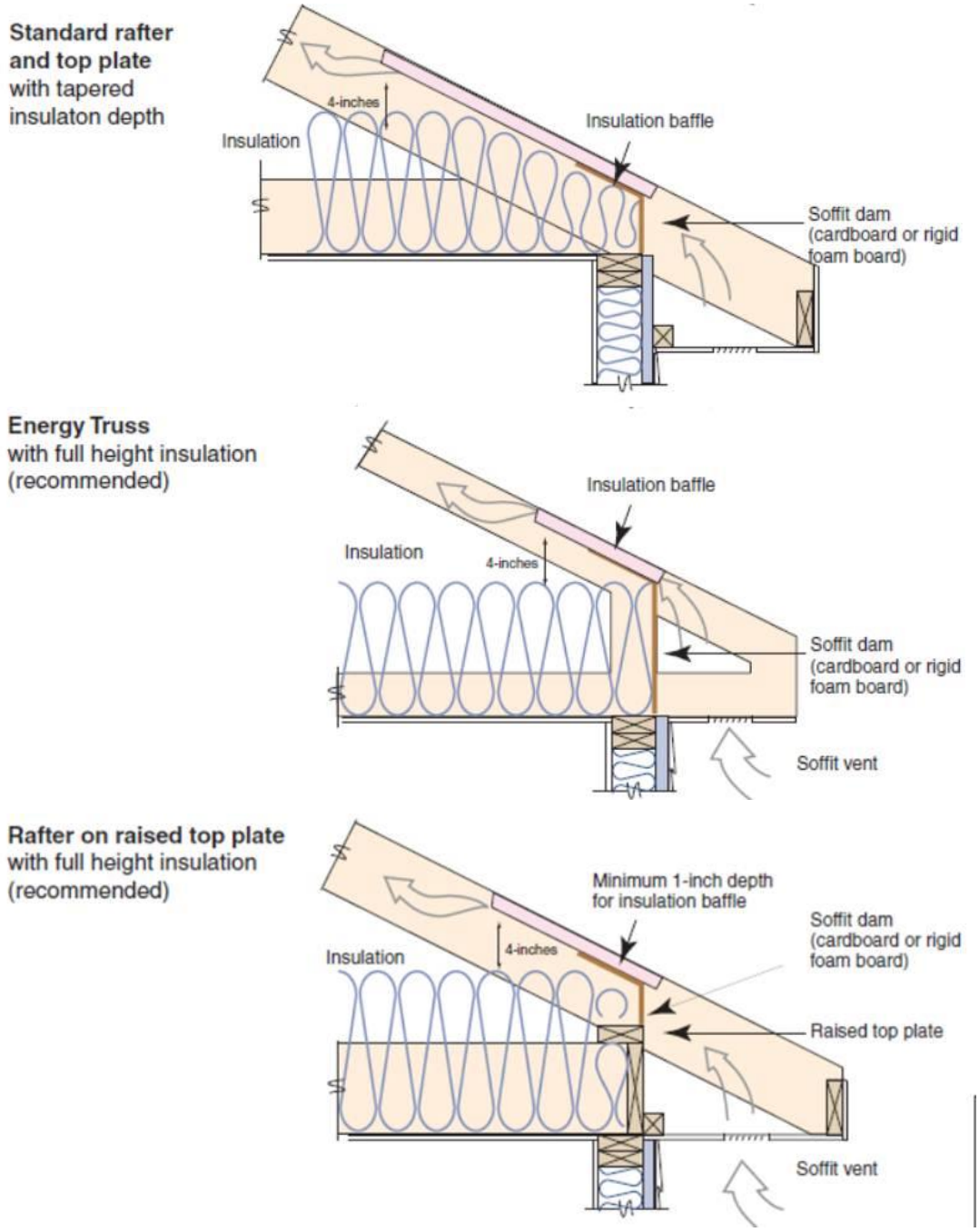


Figure 4-1. Raised Heel Truss (Energy Truss)

Source: ~~Building America Solutions Center~~ Georgia Department of Community Affairs

Section 3.6.3.4

Figure 3-47 – Properly Installed Rigid Insulation with Flashing
Source: ~~2015 International Residential Code~~ *U.S. Environmental Protection Agency*

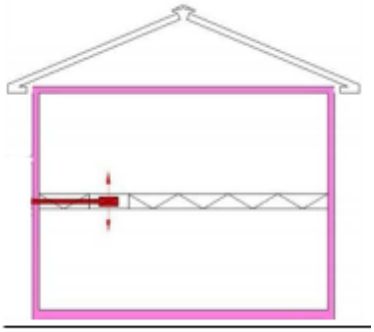
5. COMMENTS ON CHAPTER 4 – BUILDING HVAC REQUIREMENTS

Page	Paragraph/section	Suggested Revision	Comments
4-132	Top of page	Update all page number beginning with the first page of Chapter 4 with "Page 4-1"	The page numbering is off. The beginning of Chapter 4 begins with "Page 4-132" and the proceeding page is labeled "Page 4-1".
4-132	3rd paragraph, Item #3	This section addresses the requirements for air distribution systems, including mandatory measures, prescriptive requirements and compliance options.	This chapter section description includes examples (i.e. such as …), where other chapter section descriptions don't. Modify to be consistent with the other section descriptions.
4-1	Item #8	This section addresses the requirements for Refrigerant Charge verification including procedures, prescriptive requirements and compliance options.	Modifying to be consistent with the other section descriptions.
4-2	4.1.2.2 Item #4	The prescriptive requirements for ventilation cooling have been changed. The total airflow requirement was reduced from 2 CFM/ft2 to 1.5 and the vent free area was reduced from 1 ft2/375 CFM to 1 ft2/750 CFM §150.1(c)12).	This statement is misleading. The prescriptive requirement for ventilation cooling was included in the 2013 Standards. Also, there are no whole house fans that are not designed to provide ventilation cooling.
4-4	4.1.4.1	During the plan review process, the builder is responsible to show compliance with the Appliance Efficiency Regulations by providing the efficiency of the HVAC equipment that is to be installed.	Suggest stating who is responsible rather than who must provide.
4-5	1, first sentence	Additionally, the field inspector is responsible for verifying that the installed HVAC equipment is certified to the Energy Commission.	Suggest stating who is responsible rather than who must provide it.
4-5	2, last sentence	…the inspector is responsible for issuing a correction notice to the builder/installing	Suggest stating who is

Page	Paragraph/section	Suggested Revision	Comments
		contractor.	responsible rather than who shall issue it.
4-7	4.2.1.1, first sentence	…California Appliance Efficiency Regulations (Title 20).	Add (Title 20) for clarification.
4-7	4.2.1.1.1, first paragraph	Gas and oil-fired central furnaces with outputs less than 225,000 Btu/hr are rated according to their Annual Fuel Utilization Efficiency (AFUE). The minimum AFUE for small gas central furnaces is 80% and 78% for small oil-fired central furnaces	This paragraph isn't consistent with Title 20. Also it combines gas and oil with the same AFUE, which is not accurate.
4-7	Table 4-1	Insert Table E-6 Standards for Gas- and Oil-Fired Central Furnaces Less Than 225,000 Btu/hour Input And Residential Electric Furnaces and Table E-5 Standards for Commercial Gas- and Oil-Fired Central Furnaces from Title 20	This table is not up to date.
4-11	1st paragraph, second sentence	Additionally, all gravity gas wall heaters, floor heaters, room heaters ~~and,~~ fireplaces, decorative gas appliances, wood stoves and non-central electric heaters do not need to be controlled by require a setback thermostat.	Grammatical change.
4-12	3rd paragraph	~~The load calculations may be prepared by 1) a mechanical engineer, 2) the mechanical contractor who is installing the equipment or 3) someone who is qualified to do so in the State of California according to Division 3 of the Business and Professions Code~~.	This is a big compliance issue. Typically, for new construction or additions, the energy consultant (EC) prepares the load calculations. According to this if the EC isn't one of the categories above then it isn't allowed. Suggest removing this sentence.
4-13	4.2.2, 1st paragraph	Prescriptive Component Package A requires the installation of a gas heating system or a heat pump meet the minimum energy efficiency specified by the mandatory measures (see above).	Clarify language
4-14	4.2.3.1, 2nd sentence	With the performance compliance method, compliance credit is available for selecting higher efficiency heating equipment, such as a high efficiency furnace or heat pump.	Clarify language

Page	Paragraph/section	Suggested Revision	Comments
4-16	4.3.1.1.2, 1st sentence	The current Appliance Efficiency Regulations for ~~larger~~ central air conditioners and heat pumps, and all room air conditioners and room air conditioner heat pumps shall be certified to the Energy Commission by the manufacturer to have values no less than the values listed in Table 4-7 and Table 4-8.	Table 4-7 includes both large and small equipment categories; the term "larger" is irrelevant. Suggest rewriting for clarity.
4-19	4.3.1.2, 4th paragraph	Insulation used for the suction line must be protected from physical damage or from UV deterioration when it is located outside of the conditioned space.	Clarify language
4-20	4.3.1.3, 2nd sentence	The manufacturer installation instructions include requirements for minimum horizontal and vertical distance to surrounding objects that should be met if greater than that required by the Standards.	Need to include "vertical".
4-21	4.3.1.4, 2nd sentence	Avoiding oversizing the cooling equipment is especially important to ensure the required efficiency is achieved. Ducts must also be sized correctly to ensure mandatory airflow requirements.	Clarify language
4-22	4.3.2, 1st sentence	The Prescriptive Component Package A does not require that a cooling system be installed.	There are no longer multiple prescriptive packages, suggest rewriting for clarity. Suggest changing it from plural "packages" to singular "package A" and "do not" to "does not."
4-23	4.3.2.1, 1st sentence	The MAH provides a non-intrusive means for refrigerant charge verification by HERS raters and other third party inspectors,…	Clarify language
4-25	4.3.3.1, 2nd sentence	The efficiencies are reported in terms of Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER).	The technical term is Seasonal Energy Efficiency Ratio (not Rating) and Energy Efficiency Ratio (not Rating).

Page	Paragraph/section	Suggested Revision	Comments
4-33	4.4.1.1, 2st paragraph, last sentence	The prescriptive Return Duct System Design Method does not have to be HERS verified	The wording is inconsistent with the method described.
4-42	4.4.1.18, 2nd paragraph, 5th sentence	Due to these operational characteristics, systems with multispeed compressors are required to perform airflow and fan efficacy testing in the highest speed with all zones calling.	Clarify language
4-44	Table 4-13, footnote #3	3. The Standard House Defaults for all cases are 350 CFM/ton and 0.58 W/CFM.	The word "House" is confusing. Please clarify what this is referring to.
4-45	Figure 4-8	Remove duplicate (second copy) of Figure 4-8 and caption.	Figure 4-8 appears twice and the caption below the second copy is labeled "Figure 3-3-19". Suggest deleting one of the figures and eliminating the wording "Figure 3-3-19 – Ventilated Attic Prescriptive Compliance Choices"
4-46	Figure 4-9	Figure 4-~~8~~ 9 Checklist for Prescriptive Requirement - Option C DCS (§ 150.1(c).1)	This checklist refers to "Figure 4-9 Checklist for Prescriptive Requirements – Option C DCS" but the caption below the figure refers to Figure 4-8. Please clarify which one is correct.
4-46	Figure 4-9, 1st sentence	The checklist in Figure 4-9 lists all the prescriptive DCS requirements that must be met in order to meet prescriptive requirements using DCS strategy.	Suggest revising to say "DCS" rather than "roof/ceiling" since there are not only roof/ceiling requirements, but also other requirements, such as: R6 or R8 ducts and verified ducts in conditioned space.
4-47	4.4.2.1.1, 3rd sentence	~~Sometimes soffit spaces for duct runs are turned into room ceiling design features that change a flat ceiling into a tiered~~	This statement is confusing and unnecessary since there is no example

Page	Paragraph/section	Suggested Revision	Comments
		~~ceiling.~~	of a tiered ceiling. Suggest deleting it
4-50	4.4.2.1.3, Figure 4-13 diagram on left side		May want to remove the red line next to the duct cross-section, it looks like the duct runs to unconditioned space and could be misleading.
4-51	1st paragraph, 3rd sentence	A conditioned plenum could provide enough space for ducts and equipment; therefore a mechanical closet may not be needed.	Statement is broad as is.
4-69	4.6, 1st paragraph	As houses have been tightened up over the last several years due to rising energy cost and the availability of higher performing building materials, normal infiltration and exfiltration has significantly reduced. This condition has increased the effect of contaminants and pollutants introduced through common building materials, cleaners, finishes, packaging, furniture, carpets, clothing, and other products.	The use of "thousands of chemicals" isn't substantiated. Suggest revising for clarity and accuracy.
4-72	4.6.1.1, 1st paragraph	When the performance compliance approach is used, the Whole-building Ventilation system is calculated based on the total conditioned floor area (CFA) and the number of bedrooms (see Section 4.6.3.1 Fan Ventilation Rate Method). Therefore, it is important that these values are input into the compliance software correctly and checked by the plans examiner. The performance Certificate of Compliance (CF1R) will report:	Clarify language .
4-72	4.6.1.1, 1st paragraph, item #2	System type selected (i.e. exhaust, supply or balanced)	Suggest adding example for clarity.

Page	Paragraph/section	Suggested Revision	Comments
4-72	4.6.1.2, 1st paragraph	The builder/installer must complete a Certificate of Installation (~~i.e.~~ CF2R-MECH-27) for the dwelling that identifies the installed mechanical ventilation and IAQ.	Suggest deleting "i.e." because this is the actual form.
4-76	Last paragraph, 2nd and 3rd sentence	This strategy, called Central Fan Integrated (CFI) ventilation, uses negative pressure in the return plenum to pull outdoor air in through the ventilation air duct and into the return plenum, ~~T~~then the central system air handler distributes the ventilation air through the house.	Suggest removing the period and inserting a comma.
4-77	Last "Note"	~~"Note: the outside air (OA) ducts for CFI ventilation systems shall not be sealed/taped off during duct leakage testing. However, CFI OA ducts that utilize controlled motorized dampers, that open only when OA ventilation is required to meet ASHRAE Standard 62.2, and close when OA ventilation is not required, may be configured to the closed position during duct leakage testing."~~	This note is an almost duplicate of the 4th paragraph. Suggest deleting or combining it.
4-89	4.6.4.1, 2nd paragraph	"The Standards include prescriptive requirements for central system air handler fan Watt draw for all cooling systems."	Refers to the 2008 Standards.
4-89	4.6.4.1, 2nd paragraph, 4th sentence	"This fan Watt draw must be measured by the installer and verified by a HERS rater"	Suggest revising for accuracy.
4-90	4.6.5, 1st paragraph, 3rd sentence	"The ~~2008~~ Standards recognize the limitations of these indirect methods of providing ventilation to reduce moisture and odors and requires that these spaces be mechanically exhausted directly to outdoors even if windows are present."	Delete the reference to "2008".
4-97	4.6.6.5, 2nd paragraph	~~"If an air handling unit (furnace) is located in the garage, or return ducts are located in the garage (regardless of the air handler location) the entire duct system must meet the sealed and tested ducts criteria."~~	This is a mandatory requirement regardless of the air handler location. We suggest deleting it.
4-97	Example 4-28	~~Example 4-28 – Garages~~ ~~**Question**~~ ~~The building designer located the air~~	This is a mandatory requirement regardless of

Page	Paragraph/section	Suggested Revision	Comments
		~~handler in the garage. The main return trunk from the dwelling is connected to the air handler. Is this acceptable?~~ ~~**Answer**~~ ~~Yes, provided that the duct system is leak tested at 25 Pa. and sealed, if necessary, to have leakage no greater than 6 percent of the total fan flow.~~	the air handler location. We suggest deleting it.
4-97	Example 4-29	~~Example 4-29~~ ~~**Question**~~ ~~The building designer located the air handler in the dwelling unit. A return duct runs through the garage to a bedroom above the garage. The duct has only 4 ft of length in the garage. How do I test that length of the duct?~~ ~~**Answer**~~ ~~This design is allowed but the entire duct system must be leak tested at 25 Pa. and sealed, if necessary, to have leakage no greater than 6 percent of the total fan flow. There is no test available to leak test only the garage portion of the duct system.~~	This is a mandatory requirement regardless of the air handler location. We suggest deleting it.
4-104	4.6.7.3, 1st sentence	"Compliance with the ventilation airflow requirements for a ventilation system applies to Local Ventilation only and can be demonstrated in one of two ways listed below. All Whole-building Ventilation System must be tested and verified by a HERS rater."	This is misleading, need to distinguish this is for "Local Ventilation" only and all Whole-building Ventilation System shall be tested and verified by a HERS rater.
4-109	4.6.8.2, 3rd paragraph	"In order to verify compliance with these requirements, a blower door test must be conducted on each individual dwelling unit, following the procedures of RA3.8, as if the unit were exposed to outdoor air on all sides, top, and bottom by opening all doors and windows of all adjacent dwelling units."	This requirement is a significant compliance issue and should be listed in "What's Changing for 2016."
4-110	4.7.1, paragraph 3	~~Cool air rises by gravity over heated panels or finned tubes and warms the air in the room.~~ Cool air drawn by gravity over heated panels or finned tubes is heated and pushed upwards to warm the room.	Suggest replacing original sentence.

Page	Paragraph/section	Suggested Revision	Comments
4-110	4.7.1.1.1, 1st paragraph	The typical residential hydronic heating system operating between 105° and 140° F must have at least 1 inch of insulation on pipes less than 1 inch in diameter, and 1.5 inches of insulation on pipes 1 inch and less than 1.5 inches in diameter. Systems operating between 141° and 200° F must have at least 1.5 inches of insulation on pipes less than 1.5 inches in diameter. For other temperatures and pipe insulation characteristics see Tables 120.3-A in the Standards	Suggest revising to be consistent with the Standards
4-116	Example 4-41, Answer 1	(1) The supply lines not installed within a concrete radiant floor must be insulated in accordance with §150.0(j)2— System operating between 105° and 140° F must have at least 1 inch of insulation on pipes less than 1 inch in diameter, and 1.5 inches of insulation on pipes 1 inch and less than 1.5 inches in diameter. Systems operating between 141° and 200° F must have at least 1.5 inches of insulation on pipes less than 1.5 inches in diameter.	Suggest replacing the second part of answer 1 to be consistent with the Standards
4-116	4.7.3, last sentence	For the ~~2013~~ 2016 Energy Efficiency Standards, performance credit is allowed only for indirect and indirect-direct evaporative cooling systems.	Change “2013” to “2016”.
4-119	4.7.6.2, last sentence	Both the proposed design and the standard building are modeled with the same system, for example, with the overall heating system efficiency equivalent to a ~~78~~ 80 percent AFUE central furnace with ducts in the attic insulated to Package A and with diagnostic duct testing.	Change “78” to “80”.
4-130	Example 4-47, Answer	"Yes, if you are complying prescriptively. If you are complying using the performance method, then no." “whole house fans…” in a new paragraph	Technically this should include “Yes.”

Page	Paragraph/section	Suggested Revision	Comments
4-130	Example 4-48, Answer	"Yes Whole house fans move a lot of air, all of which is exhausted to the attic. Without sufficient attic relief to outdoors, the air velocity will increase (potentially disturbing blown insulation), and the fan will move less air."	Technically this should include "Yes."
4-130	Example 4-48, Answer	"Yes Section 150.1(c)12 requires..." in a new paragraph	Technically this should include "Yes."
4-134	4.8.2, 1st sentence	During the construction process, the general contractor and/or specialty subcontractors must complete all ~~the~~ applicable sections of an Installation Certificates (CF2R) including ~~for~~ any building design special feature specified on the Certificate of Compliance (CF1R).	This statement is incorrect as written and should be clarified.
4-137	4.9.1.1, 1st sentence	"An air conditioning system undergoes its final assembly at the time of installation.	This statement should include both split and packaged systems.

6. COMMENTS ON CHAPTER 5 – WATER HEATING

Page	Paragraph/Section	Suggested Revision	Comments
ii	Table of Contents	Update page numbers	Some page numbers are wrong or not referencing anything.
5-1	5.1	"Chapter 5 describes the Title 24 compliance requirements for domestic water heating for residential dwellings, including single family, and low-rise (three or fewer habitable floors), multifamily buildings with a dedicated water heater for each individual dwelling unit, and low-rise multifamily buildings with a central DHW system."	See pages 5-25 to 5-32, 5-34, 5-41 to 5-42, and 5-75
5-1	5.1.1	There is no longer a prescriptive option that allows electric ~~Prescriptive Requirements:~~ water heating. Users that wish to use electric water heating can comply with the Standards using the performance approach.	The words "Prescriptive Requirements" do not belong in this sentence.
5-2	5.1.1.2	Heading: Prescriptive Requirements	Be clear: What about New Construction, Additions? Alterations?
5-2	5.1.1.2	The prescriptive requirements for family buildings and multi-family buildings with a dedicated water heater ~~in~~ for each dwelling unit have been updated.	Grammatical fix
5-2	5.1.1.2	~~Mandatory Requirements:~~ in each dwelling unit are as follows: Option 1:	The words "Mandatory Requirements" do not belong in this sentence. The words should be deleted.
5-2	5.1.1.2	Option 2: In addition, the building must comply with the HERS verified Quality Insulation Installation (QII) requirements (see Chapter 2 Section 3.6.3.4 (B) of the Compliance Manual) as well as one of the following requirements:	Applies to additions? E+A+A?
5-3	5.1.1.3	The Point of Use Distribution credit no longer requires HERS verification.	Conflicts with Table 5-9 (table is probably wrong)

Page	Paragraph/Section	Suggested Revision	Comments
5-3	5.1.2	Fix the spelling error "Secion" in Table 5-1	It should be "section"
5-3	5.1.3	Approximately 90% of California homes have natural gas water heating, with the common water heater type being a 40 or 50 gallon atmospheric combustion storage water heater	Add the word 'combustion'
5-4	5.1.3	Energy impacts associated with the hot water distribution system vary widely based on the type of system, hot water set point, quality of insulation and installation, building and plumbing design, and hot water use patterns.	The set point temperature can make as much difference as most of the factors named.
5-6	5.2	Residential water heaters primarily provide hot water…There are several types of residential water heaters described below.	Add a period at the end of this sentence.
5-9	5.2.1	These units do not have a tank for storing heated water but instead use a sensor that detects the flow of water over the heat exchanger that initiates the heater (typical volumes around 0.5 gallons).	'burners' implies gas; say 'heater'
5-10	5.2.1	Electric instantaneous water heaters are not allowed through the prescriptive approach to compliance but can be installed using the performance approach as on as the water heating energy budget is not exceeded.	Water heating budget only? Or total energy budget?
5-11	5.2.1	To comply prescriptively, a user can choose to install a natural gas or propane storage water heater with a rated storage volume over 55 gallons with an input rating of 105,000 BTU/hr or less as long as the water heater meets the minimum requirements in California's Title 20 Appliance Efficiency Regulations Section 1605.1 (f) for federally-regulated appliances, and the building complies with one of the following:	Add the words 'or less' In addition, we recommend adding the following statement somewhere in this section: "Note that for water heaters above 55 gallons the minimum energy factor required by the Federal Regulations jumps up substantially."
5-12	5.2.2.2	Residential-duty commercial water heaters not are allowed through the prescriptive approach to compliance and can be installed	This equipment has input ratings that are greater than what is allowed by

Page	Paragraph/Section	Suggested Revision	Comments
		using the performance approach as long as the water heating energy budget is not exceeded.	the prescriptive standards (i.e. it runs contrary to the prescriptive 5-12requirements).
5-12	5.2.2.2	Residential water heaters have a storage capacity up to 100 gallons where commercial water heaters typically have a storage water heater of 120 gallons or greater.	Since the residential size is up to 100 gallons, and the nonresidential size starts at 120 gallons, it would help the reader to have a sidebar explanation somewhere in this section.
5-12	5.2.2.3	~~There are no federal or state minimum efficiency standards for heat pump water heaters~~.	As of April 2015, all electric water heaters have to have an EF of 2.057 - (0.00113 x storage cap. in gals.). This does apply to HP WHs, in fact, HP WHs are the only ones that meet this federal standard. We recommend deleting the sentence.
5-13	5.2.3 Paragraph 1	This section presents best practices for maintaining the life and efficiency of water heaters.	Indicate that this section is a 'best practice' and not a requirement of the code.
5-16	5.3	Page headings (on pages 5-16 to 5-19) say: "Water Heating Requirements – Mandatory Requirements for Water Heating~~ers~~"	Correct to say 'Heating'
5-13 to 5-19	5.3	Fix duplicate page numbers (page numbers 5-13 to 5-19 are used more than once and are not in order).	Correct order of and duplicate page numbers.
5-19	5.3.4	4. A gas supply line with a capacity ~~of~~ to provide at least 200,000 BTU/hr to the water heater.	Delete "of."
5-19	5.3.4.1	As a result, ~~this~~ the standards require that a Type B vent…	Grammatical fix
5-19	5.3.4.1	'The installation shall meet all code and manufacturers' ~~manufactures~~ guidelines.	Fix typo

Page	Paragraph/Section	Suggested Revision	Comments
5-19	5.3.4.1	"There should be no bends along the path of the Type B vent.~~, except the portion of the Type B vent outside the building and in the space where the water heater is installed."~~	The language is contradictory to the standards. The standards state: "…Type B vent with straight pipe between the outside termination and the space where the water heater…" (Section 150.0 (n)2) .
5-13 (duplicate page number)	5.3.4.2	The requirement for the condensate drain being placed near the water heater and no higher than the base of the tank allows the condensate to be removed without relying on a sump pump.	What if installed in a basement or other below grade application?
5-14 (duplicate page number)	5.3.5.1	Note that the installation shown in Figure 5-3 below would not meet the installation requirements since they are not insulated ~~if supplying the kitchen.~~	The sentence is missing the reference to the figure. Additionally, this sentence is confusing as it refers to both below grade and supplying the kitchen.
5-14 (duplicate page number)	Figure 5-3	Figure 5-3 – ~~Non-Compliant Below Grade Piping.~~ The below grade piping shown in the photo above is non-compliant because the pipes are un-insulated and because the hot and cold water lines are not separated.	Aside from being a picture of non-compliant below-grade plumbing, this picture illustrates another common error: unseparated hot and cold water lines. We recommend revising the caption so the reader does not think it is okay to do that.
5-16	5.3.5.3	The recirculation loop is comprised of a supply portion…that serves multiple dwelling units, guest rooms, or common area fixtures, and a return portion…The large volume of water ~~which~~ that is recirculated…	Clarify language and fix grammar
5-18	5.3.6 Example 5-10	Question When I'm insulating the pipes for a recirculating water heating system, I	Clarify language

Page	Paragraph/Section	Suggested Revision	Comments
		understand that I must insulate the entire length of hot water pipes that are part of the recirculation loop. Do I also need to insulate the runouts? Answer No, other than the pipe to the kitchen fixtures. Since the water in runouts does not recirculate, ~~they~~other runouts do not need to be insulated."	
5-19	5.3.6 Example 5-12	"The reason for ~~this~~ insulating the cold line ~~requirement~~ is that when heated, the water in the water heater expands and pushes hot water out the cold water line."	Clarify language
5-21	5.4.1	Insulate all domestic hot water pipes, which requires that a HERS rater verify that the pipe insulation is designed and installed in accordance to Title 24 Energy Standards. ~~Use a compact hot water distribution design, which requires a HERS rater to verify that the system has been designed and installed in accordance with Title 24 Standards (see Reference Appendix RA4.4.16).~~	Redundant language. Suggest deleting the sentence.
5-21	5.4.1	Note that for water heaters above 55 gallons, the minimum energy factor required by the Federal Regulations is higher than the minimum energy factors for storage water heaters that are 55 gallons and non-condensing gas instantaneous water heaters.	We suggest **adding** this sentence somewhere in this section so readers are aware that the efficiency of this type of water heater is higher than the other water heaters allowed through the prescriptive requirements.
5-21	5.4.1	"For more information on QII compliance requirements see Chapter 3 (Building Envelope) of this Compliance Manual and Section RA3.5.36.3.4(A) (Batt and Blanket Insulation) of the Reference Appendix."	Since there are three parts to the reference appendices, the section reference needs the "RA" in the section number.
5-22	5.4.1	"For more information on HERS-verified domestic hot water pipe insulation requirements see Section 5.6.2.5 of this Compliance Manual."	Clarify language
5-22	5.4.1	'F' (top left section of page)	This 'F' should be

Page	Paragraph/Section	Suggested Revision	Comments
			deleted.
5-22	5.4.1	"Pipe insulation requirements do not apply to alteration ~~if~~ for pipes that are inaccessible."	Without this clarification, a builder might think that the exception applies to all pipes, if part of the piping is inaccessible.
5-23	5.4.1	If using the Standard Distribution System, all pipes from the water heater to the kitchen must be insulated and all pipes with a diameter equal to or greater than ¾ of an inch must be insulated.~~, or~~ and e) If using a recirculation distribution system, only Demand Recirculation Systems with manual control pumps are allowed.	Fix grammatical issues.
5-24	5.4.1	*5.4.1.1 Compliance Forms* All compliance forms can be downloaded from CEC's website: http://www.energy.ca.gov/title24/2013standards/res_compliance_forms/ • Certificate of Compliance ○ Prescriptively Newly Constructed Buildings (Form CEC-CF1R-NCB-01-E) ○ Prescriptive Residential Additions 1,000 square feet or less (Form CEC-CFR1-ADD-01-E) ○ Prescriptive Residential Alterations (Form CEC-CF1R-ALT-01-E) • Certificate of Installation ○ HERS QII – Insulation Stage (Form CEC-CF2R-ENV-23-H) ○ HERS QII – Framing Stage (Batt, Loose, Fill, SPF)(Form CEC-CF2R-ENV-21-H) ○ HERS QII – Framing Stage (SIP, ICF) (Form CEC-CF2R-ENV-24-H) ○ HERS Single Dwelling	We recommend including a list of relevant compliance forms, as it would be more convenient and helpful to users.

Page	Paragraph/Section	Suggested Revision	Comments
		Unit Hot Water System Distribution (pipe insulation and compact design) (Form CEC-CF2R-PLB-22-H) ○ Single Dwelling Unit Hot Water System Distribution (Non-HERS) (Form CEC-CF2R-PLB-02-E) • Certificate of Verification ○ HERS QII – Insulation Stage (Form CEC-CF3R-ENV-23-H) ○ HERS QII - Framing State (Batt, Loose, Fill, SPF) (Form CEC-CF3R-ENV-21-H) ○ HERS QII – Framing Stage (SIP, ICF) (Form CEC-CF3R-ENV-21-H) ○ HERS Single Dwelling Unit Hot Water System Distribution (pipe insulation and compact design) (Form CEC-CF3R-PLB-22-H)	
5-25	5.4.1.1 Example 5-3	If my house currently has electric-~~resistant~~ resistance water heating but I upgrade my water heater, do I need to install a gas instantaneous or gas storage water heater?	Fix typo
5-25	5.4.1.1 Example 5-4	If the addition will have its own water heater, or if it will be connected to the existing hot water distribution system in order to supply hot water to the apartment then you must comply with the standards either through the prescriptive or performance path…If taking the performance approach, you can install any type of water heater as long it…2) does not exceed the water heating energy budget for the self-contained ~~building~~ dwelling. addition (see Section 5.5).	As an addition, it is still part of the "building."
5-25	5.4.1.1	"To comply prescriptively, you can install a gas storage water heater that is over 55	WE recommend deleting the part of the sentence

Page	Paragraph/Section	Suggested Revision	Comments
	Example 5-5	gallons as long as the unit uses condensing technology."	about condensing technology since it's not stated in the Standards.
5-25	5.4.2	5.4.2 Multiple Dwelling Units: Multi-family, Motel/Hotels and High-Rise ~~Nonresidential~~ Residential	Fix typo
5-26	5.4.2	"In addition, if a central recirculation system is installed, it shall be installed with ~~controls and a distribution layout that will include~~ demand recirculation controls and a distribution layout with at least two recirculation loops."	Clarify language.
5-26	5.4.2	"Pipe heat loss is affected by pipe surface area, pipe insulation level, and the temperature difference between the hot water and ambient air~~, pipe insulation level, and pipe surface area~~."	Clarify language.
5-26	5.4.2	The motivation behind having two loops is to reduce recirculation pipe sizes, thus pipe surface area~~s~~. This measure reduces energy use~~s~~ and piping materials associated with recirculation systems.	Fix grammar
5-27	5.4.2.1	"The total pipe surface area is effectively reduced, even though total pipe length is about the same as or somewhat greater than that of a single-loop design."	Real world installations are not like the idealized diagram in Figure 5-6, so the claim that the length is about the same is not justified.
5-27	5.4.2.1	In general, the system should be designed to have each loop serve ~~the~~ an equal number of dwelling units in order to minimize pipe sizes.	Fix grammar
5-28	5.4.2.1	"In all cases, simple routing of recirculation loops should be used to keep recirculation pipes and runouts as short as possible."	It is almost as important to minimize the length of runouts as it is to minimize the length of the recirculation loop.
5-28	5.4.2.1 Figure 5-7	Figure 5-7 caption: Examples of ~~dual~~ multiple-loop recirculation system designs in buildings of complicated shapes	This is a bit of a misnomer. The layout of the "tee" shaped building

Page	Paragraph/Section	Suggested Revision	Comments
			is a treble-loop, not a dual-loop. Perhaps the caption should say "Examples of multiple-loop recirculation..."
5-29	5.4.2.1	Based on feedback~~s~~ from industry stakeholders, most solar water heating systems are only configured as a pre-heater of the primary gas water heating equipment.	"Feedback" is both singular and plural. Delete the "s" on the end.
5-29	5.4.2.2	The prescriptive requirement for domestic hot water systems serving multiple dwelling units requires the installation of a demand recirculation control to minimize pump operation and heat loss from the pipes. Please note that they are different from the demand controls used in single dwelling units, as described in Section ~~5.6.2.6~~ 5.6.2.7."	The electricity savings on pump operation is at least an order of magnitude less than the gas savings from reduced pipe losses. Section 5.6.2.6 describes non-demand recirculation controls for single dwellings, while 5.6.2.7 describes demand controls for recirculation in single dwellings.
5-29	5.4.2.2	"Demand controls for central recirculation systems ~~are based on~~ operate by sensing hot water demand and recirculation return temperatures"	The existing language is unclear. Clarify language.
5-29	5.4.2.2	"The temperature sensor should be installed on the recirculation loop close to~~at~~ the last branch pipe ~~along the recirculation loop~~."	The existing language makes it sound like the sensor ought to be on the last branch pipe.
5-29	5.4.2.2	5.4.2.3 Compliance Forms All compliance forms can be viewed at the CEC Title 24 website: http://www.energy.ca.gov/title24/2013standards/res_compliance_forms/ • Certificate of Compliance ○ Prescriptively Newly Constructed Buildings (Form CEC-CF1R-NCB-01-E) ○ Prescriptive Residential Additions 1,000 square feet or less (Form CEC-CFR1-ADD-01-E) ○ Prescriptive Residential	We recommend including a list of relevant compliance forms, as it would be more convenient and helpful to users.

Page	Paragraph/Section	Suggested Revision	Comments
		Alterations (Form CEC-CF1R-ALT-01-E) • Certificate of Installation ○ HERS Multifamily Central Hot Water System Distribution (Form CEC-CF2R-PLB-21-H) ○ Multifamily Central Hot Water System Distribution (Non-HERS) (Form CEC-CF2R-PLB-01-E) • Certificate of Verification ○ HERS Multifamily Central Hot Water System Distribution (Form CEC-CF3R-PLB-21-H)	
5-29	5.4.2.3 Example 5-6	"The other is to use separate gas waters for each dwelling unit, as in this example. In order to use this compliance method, all dwelling units must use residential water heaters or Residential-Duty Commercial water heaters (heat input of less than 1075,000 BTU/hr) with EF ratings equal or higher than corresponding Title 20 appliance standard requirements. Other requirements also pertain. See the three options in Section 150.1(c)8 of the Energy Standards."	The answer as written is correct, but incomplete.
5-30	5.4.2.3 Example 5-8	"There is an exception for multi-family buildings of eight units or less. ~~using the performance approach~~"	The exception is in the prescriptive approach.
5-30	5.5.2	"and does not take credit for any additional DHW design features ~~eligible for energy credits~~."	Clarify language
5-30	5.5.2	The calculated energy use of the proposed design is compared to the standard design energy budget based on a single natural gas instantaneous water heater with a Standard ~~hot water~~ ~~d~~Distribution ~~s~~System.	Should use “Standard Distribution System” for consistency.
5-30	5.5.2	"~~As per the prescriptive requirements,~~ ~~a~~ll mandatory pipe insulation requirements	Clarify language

Page	Paragraph/Section	Suggested Revision	Comments
		must be met, such as insulating all pipe ~~lengths~~ running to the kitchen ~~must be insulated~~"	
5-30	5.5.2	Adding multiple water heaters to a single family design will generally result in an energy penalty in the water heating budget that must be offset elsewhere in the overall performance compliance.	The language throughout this chapter refers to the water heating budget when talking about complying via the performance path but this language implies it's the total energy budget. Which is it?
5-31	5.5.2	Table 5-9 **Optional Cases: HERS Inspection Required**	This text should also be in bold since "No HERS Inspection Required" is in bold.
5-35	5.5.5	When the performance approach is used, a high efficiency water heater can significantly impact the overall performance margin of a building especially in the milder climates like climate zones 4 through 9, where water heating typically represents a larger fraction of the overall ~~house~~ energy budget.	We recommend deleting "house" since the low-rise res standard also apply to multi-family, and this statement is even truer for multi-family than for a "house."
5-34	5.6.2.1	5.6.2.1.~~1~~ Standard Distribution System (Trunk and Branch and Manifold Configurations)	There is an extra "1" in the section number that should be removed.
5-34	5.6.2.1	"A Standard Distribution System ~~may or~~ may not incorporate a pump for hot water recirculation."	This is not true with "may or" in the sentence. The "Standard Distribution Multiplier" must be modified per Equation RE-4 when there is a recirculation pump in the system. Even when the pump has a manual control, the SDM is increased by roughly 1.5% to 3% for apartments 600 sq.ft. to 1000 sq.ft.
5-35	5.6.2.1	No pumps may be used to recirculate hot water with the Standard system.	Why was this first sentence deleted? Isn't it

Page	Paragraph/Section	Suggested Revision	Comments
		Distribution…	true?
5-35	5.6.2.1	When designing a trunk and branch system, the concern is keeping all segments of the system as short and as small a diameter as possible.	Clarify language
5-36	5.6.2.3	All applicable mandatory features must be met, and the distance between the water heater and any fixture using hot water cannot exceed the length specified in ~~Table 5-9~~ Table 5-10 below…	Fix table number
5-36	5.6.2.3	The CASE Team suggests replacing the floor plan graphic (Figure 5-10) with a better graphic.	The current graphic is low quality and hard to see.
5-38	5.6.2.4	Table ~~5-10~~ Table 5-11 below specifies the maximum pipe run length that meets the compact design	Fix table number
5-38	5.6.2.4	…is the option of using Compact Hot Water Distribution Design in combination with a 55 gallon or less propane or natural gas storage water heater (and Quality Insulation Installation~~, if installing a gas small storage water heater that is 55 gallons or less~~)."	Clarify language
5-39	5.6.2.4	Fix the placement of the red outlined boxes on Figure 5-11 and Figure 5-12.	The red outlined boxes are meant to be placed over the water heater ("WH") locations on the floor plans but they have shifted outside of the floor plans.
5-40	5.6.2.4	Table 5-~~8~~11	Table numbering is off
5-40	5.6.2.5	Compliance credit is available in the performance compliance approach if all piping in the hot water distribution system is insulated from the water heater to each fixture of appliance…Additional credit is available if the insulation is verified by a HERS inspection. A credit is not available if complying prescriptively with the standards by installing a gas storage water heater, as	A credit is not available if complying prescriptively with the standards by installing a gas storage water heater, as HERS verified pipe insulation is required.

Page	Paragraph/Section	Suggested Revision	Comments
		HERS verified pipe insulation is required.	
5-40	5.6.2.6	This type of distribution system ~~type~~ encompasses all recirculation strategies that do not incorporate ~~a~~ demand control ~~strategy~~ to minimize recirculating pump operation.	Delete redundant words.
5-40	5.6.2.6	The intent is to clearly distinguish between recirculation system control options…other strategies, where pump runs continuously or run time is much more uncertain"	Clarification. Continuous pump operation does not fit within "where pump run time is … uncertain."
5-40	5.6.2.6	Recirculation systems are known to save water ~~(since the hot water is much closer to the use points)~~…	Delete this parenthetical at it's not accurate. It is not that the hot water is closer to the use points; it is previously heated water that is not dumped down the drain and waiting for the truly hot water to arrive.
5-40	5.6.2.7	The system must have a temperature sensor, typically located ~~at the most remote point of~~ near the last branch off of the recirculation loop	Clarify language.
5-41	5.6.3.1	The standard distribution system for water heaters serving multiple dwelling units in buildings with more than eight dwelling units incorporates recirculation loops...	Clarify language.
5-41	5.6.3.1	Central recirculation water heating systems which use temperature, timer or no controls are allowed if all the mandatory measures are met and ~~can use a default recirculation system type if~~ performance compliance is used.	Existing language may be confusing to the user.
5-42	6.5.6.3	…including hot water supply temperatures, hot water return temperatures, and status of gas valve relays ~~of~~ for water heating equipment.	Fix grammar
5-43 through 5-74	Multiple sections	Fix misplaced text in header of each page. Remove unnecessary spaces.	The formatting on pages 5-43 through 5-74 needs to be edited and

Page	Paragraph/Section	Suggested Revision	Comments
		Fix font sizes. Remove blank page on 5-50. Fix Q&A formatting.	reformatted.
5-75	5-9	For more detailed instructions on installation of solar water heaters refer to Reference Appendix RA4.4.21. The sortable database of SRCC-certified equipment is located on the SRCC website…	Clarify language
5-75	5-9	Figure 5-14 summarizes the process flow for demonstrating compliance via the prescriptive and performance approaches for solar thermal systems.	Fix grammar
5-76	5.9.1.2	"A requirement for multi-family buildings with a central distribution system is that a solar water heating system be installed."	This is only true for the prescriptive approach. We suggest that Section 5.9.1.2 be combined with Section 5.9.2, eliminating any redundant text.
5-76	5.9.1.2	The table numbering and in-text references to tables are off.	Fix table numbering and references to tables in the associated text.
5-76	5.9.1.2	Delete the "2" after [climate zone] 10-16 in Table 5-9	There is climate zone 162.
5-77	5.9.2.1	Stakeholders further suggested that industry standard sizing for an active system is 1.5 ft collector area per gallon capacity ~~for~~ of the solar storage tank.	Clarify language
5-77	5.9.2.1	Because of the new solar water heating requirements and the prevalence of recirculation hot water systems in multi-family buildings, since solar tanks are typically plumbed in series ~~with~~, just upstream of the conventional/auxiliary water heating equipment…	Fix grammar

Page	Paragraph/Section	Suggested Revision	Comments
5-77	5.9.3	Solar water heating systems with a solar fraction higher than the specified prescriptive	Fix grammar
5-79	5.10.2.1	For pools equal to or less than 17,000 gallons, a pump must be chosen such that the flow rate listed for Curve A is less than the 6-hour turnover rate.	The previous paragraphs make the cut at 13,000 gallons, but this text states 17,000 gallons. Where is the reference to ***either*** in the Standards?
5-80	5.10.2.2	A s~~S~~olar system that requires pumps to run during peak hours must also have a control mechanism installed.	There is no exception that allows pumps to run during peak hours in the Standards. If CEC wants to allow such an exception, shouldn't the language in 5.10.2.2 also say what the parameters of the "control mechanism" should be (e.g., "...to minimize the amount of on-peak time that the pump runs.")?
5-83	5.11.1	**5.11.1 Compliance Forms** All compliance forms can be downloaded from CEC's website: http://www.energy.ca.gov/title24/2013standards/res_compliance_forms/ • Certificate of Compliance ○ Prescriptively Newly Constructed Buildings (Form CEC-CF1R-NCB-01-E) ○ Prescriptive Residential Additions 1,000 square feet or less (Form CEC-CFR1-ADD-01-E) ○ Prescriptive Residential Alterations (Form CEC-CF1R-ALT-01-E) • Certificate of Installation ○ HERS QII – Insulation Stage (Form CEC-	We recommend including a list of relevant compliance forms, as it would be more convenient and helpful to users

Page	Paragraph/Section	Suggested Revision	Comments
		CF2R-ENV-23-H) ○ HERS QII – Framing Stage (Batt, Loose, Fill, SPF)(Form CEC-CF2R-ENV-21-H) ○ HERS QII – Framing Stage (SIP, ICF) (Form CEC-CF2R-ENV-24-H) ○ HERS Single Dwelling Unit Hot Water System Distribution (pipe insulation and compact design) (Form CEC-CF2R-PLB-22-H) ○ Single Dwelling Unit Hot Water System Distribution (Non-HERS) (Form CEC-CF2R-PLB-02-E) ○ HERS Multifamily Central Hot Water System Distribution (Form CEC-CF2R-PLB-21-H) ○ Multifamily Central Hot Water System Distribution (Non-HERS) (Form CEC-CF2R-PLB-01-E) • Certificate of Verification ○ HERS QII – Insulation Stage (Form CEC-CF3R-ENV-23-H) ○ HERS QII - Framing State (Batt, Loose, Fill, SPF) (Form CEC-CF3R-ENV-21-H) ○ HERS QII – Framing Stage (SIP, ICF) (Form CEC-CF3R-ENV-21-H) ○ HERS Single Dwelling Unit Hot Water System Distribution (pipe insulation and compact design) (Form CEC-CF3R-PLB-22-H) ○ HERS Multifamily	

Page	Paragraph/Section	Suggested Revision	Comments
		Central Hot Water System Distribution (Form CEC-CF3R-PLB-21-H)	
5-84	5.11.3.1	…insulation on all domestic hot water piping must be installed, both of which require~~s~~ HERS verification (see Section 5.4 of this Compliance Manual).	Fix grammar
Multiple pages	Multiple sections	Check numbering of pages, tables, figures, and in-text references to tables and figure to make sure they are in order.	Formatting and page numbers seem to have been messed up when moving text around.

7. COMMENTS ON CHAPTER 6 – RESIDENTIAL LIGHTING

Page	Paragraph/Section	Suggested Revision	Comments
i	Table of Contents	Update to match document page numbers and sections.	Does not currently match page numbers and sections in document.
Multiple pages	Multiple sections	Fix typos throughout Chapter 6.	Someone with access to the Word version should go through and do a cleanup.
6-1	1	1. All permanently installed luminaires must be "high efficacy". This eliminates different requirements by room or ~~whether a particular control is installed~~ installed control type, and removes the need for calculating the wattage of low versus high efficacy luminaires in the kitchen.	Clarify language
6-1	1	2. The definition of "high efficacy luminaires" includes the light sources identified as efficient in the 2013 Standards (including linear fluorescent, pin based compact fluorescent, GU-24 base CFL, HID, and induction lighting) and has been expanded to include any luminaire that contains a JA8 compliant lamp or other light source. In other words, any luminaire can qualify as high efficacy luminaire as long as it meets the requirements of JA8 and has a JA8-2016 marked light source in it at time of inspection.	Clarify language
6-2	6.1.1.6	The builder must provide the new homeowner with a luminaire schedule (as required in Section 10-103(b) of Part 1 of the Standards)	The requirement is in Part 1 of the Administrative code (Section 10-103(b)3) and may be hard for people to find, so we suggest calling it out here.
6-4	6.1.3	There are educational resources prepared by the California Energy Commission and	We encourage CEC to review the CASE

Page	Paragraph/Section	Suggested Revision	Comments
		others that provide additional information about residential lighting, including a Guidance Document developed to further assist manufacturers of JA8 products.	Team's JA8 guidance document, edit if needed, and post it in the educational resources web addressed referenced here in the Compliance Manual. The Statewide Team can work with the CEC as needed to assist in this process.
6-7	6.2.1.1	All other luminaire types must have a light source or lamp installed in them at the time of inspection that meets the requirements of Reference Joint Appendix JA8. Note: Luminaires do not need to be shipped by manufacturers with a JA8 source installed, though they may be.	We recommend that CEC specifically point out that luminaires don't have to be shipped with JA8 source – just installed at the time of new construction/ inspection. Might make sense in Section 6.2.1.1.
6-7	6	The Energy Commission maintains a database of JA8-compliant luminaires and lamps.	It is not a database for all products that are compliant with the lighting standards. The legacy products (like GU24 CFL and linear fluorescents) are compliant with the standards, but don't have to be submitted to the database. So we suggest clarifying that the database is for JA8-compliant products.
6-12	Example 6-5	If the LED bulb is JA8-certified, and is ~~labeled~~ marked "JA8-2016,"	We recommend using the term "marked" rather than "labeled." "Labeled" could be interpreted to mean on the packaging. The standards use the term "marked." It could also be good to include a blurb to specify that a label on a package or spec sheet is *not*

Page	Paragraph/Section	Suggested Revision	Comments
			sufficient-- that the JA8 marking must be on the product itself.
6-17	B.2 2	§130.0 – ~~Lighting Systems and Equipment, and Electrical Power Distribution~~ ~~Systems – General~~ LIGHTING CONTROLS AND SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS — GENERAL	Wrong Section Name Ref (15 day language)
6-17, 6-19. 6-23	6.4.1 6.4.2 6.5.4 B.5 Paragraph 6 Paragraph 6	§141.0 – Additions, Alterations, and Repairs to Existing Nonresidential, High-Rise Residential, and Hotel/Motel ~~Occupancies~~ Buildings, To Existing Outdoor Lighting, To Internally And Externally Illuminated Signs	Wrong Section Name Ref (15 day language)
6-27	3	Where applicable, outdoor lighting shall be shown on plans or described in specifications and/or notes to be high efficacy, and to meet the control requirements outlined in Section 6.5~~.1~~	Multiple subsections of 6.5 (6.5.1 through 6.5.3) apply. Change to say Section 6.5
6-28	6.8.2 A	**A. Certificate ~~in~~of Installation**	Typo
6-28	6.8.3 1	1. Luminaires defined as high efficacy: • Pin-based linear fluorescent with electronic ballast • Pin-based compact fluorescent with electronic ballast • Pulse-start metal halide • High pressure sodium • GU-24 luminaires with light sources other than LEDs • Induction	List of high efficacy luminaires here does not include outdoor lights- is this correct?
6-29	6.8.3 3	Where applicable, inspectors must verify that outdoor lighting is high efficacy, and controlled according to the requirements outlined in Section 6.5~~.1~~	Wrong sub section reference. Update to say Section 6.5

Page	Paragraph/Section	Suggested Revision	Comments
6-32	4	Building departments, builders, contractors, and lighting designers should check ~~to~~the database to verify that a regulated device has been certified to the Energy Commission by the manufacturer of that device.	Typo
6-34	Row 4	~~≤ 30%~~ <30% for frequencies of 200 Hz or below, at 100% and 20% light output	Typo/ Duplication. This should read <30%.
6-34	Last row of table in Section 6.9.1	"No" allowed only for lamps and LED light engines with diameter less than 1.0" and decorative lamps with a diameter less than 2.0."[1] [1] Though not required, small diameter lamps may still opt to use the JA8 marking to show compliance and for ease of enforcement. If a small diameter lamp is installed *without* the JA8 marking, inspectors should ask builders to provide the luminaire schedule with the lamp's identification number from the JA8 database.	This exemption was mistakenly left in Table JA8 in the standards – initially the intent was to exempt small lamps from the marking requirements because the marking requirements were extensive and small lamps may not have enough space. However, the marking requirements were greatly reduced in the final adopted version of JA8, and small lamps should not have trouble meeting them; the exemption was removed in the body of JA8 but inadvertently left in Table JA8. Accordingly, we recommend that CEC use the Compliance Manual to explain that in most cases small diameter lamps shall be marked if they comply with JA8. If small diameter lamps are not marked, the inspector should assume that the lamps are not compliant unless the builder provides on-site the luminaire schedule with the lamps called

Page	Paragraph/Section	Suggested Revision	Comments
			out and the lamps' identification number from the JA8 database. Here we have recommended sending this message as a footnote beneath the table in Section 6.9.1.
6-35	6.9.3 3	3. Whenever a lighting control system is installed to comply with lighting control requirements in Title 24, a licensee of record must fill out and sign a~~n~~ Certificate of Installation in accordance with the requirements in §130.4. If the Certificate of Installation is not submitted, the lighting control system shall not be recognized for compliance with the Standards.	Typo
6-36	6.10.1 2	B.Number of Certificates of Installation Required A residential lighting project may require ~~only~~ one, or more than one, Certificate of Installation to be submitted. For example, if one qualified person accepts responsibility for the lighting installation of an entire lighting project, only one Certificate of Installation will need to be submitted. However, if one qualified person accepts responsibility for the installation of the lighting controls, and another qualified person accepts responsibility for the installation of the luminaires, then each qualified person will separately need to submit a Certificate of Installation.	Suggestion for Clarification
6-38	6.10.3 2	2. §150(k)2G—An Energy Management Control System (EMCS) may be used to comply with dimmer requirements in §150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with §110.9, meets the installation certificate requirements in §130.4, the EMCS requirements in §~~130.05~~130.5(f) and complies with all other applicable requirements in §150.0(k)2.	Updated wording from 15 day language

Page	Paragraph/Section	Suggested Revision	Comments
6-38	6.10.3 3	§150(k)2H –An Energy Management Control System (EMCS) may be used to comply with vacancy sensor requirements in §150.0(k) if at a minimum it provides the functionality of a vacancy sensor in accordance with §110.9, meets the installation certificate requirements in §130.4, the EMCS requirements in §~~130.05~~130.5(f), and complies with all other applicable requirements in §150.0(k)2.	Updated wording from 15 day language

8. COMMENTS ON CHAPTER 7 – SOLAR READY

Page	Paragraph/Section	Suggested Revision	Comments
General			Where equivalencies for square foot measurements in metric units are listed, the metric value is incorrect and misleading. The metric values appear to be a 1:10 ratio of the imperial value. The correct ratio (or conversion) is 1:10.764. Suggest either showing the correct metric equivalent or removing all metric references.
7-1 through 7-3		Add page numbers to header.	Pages 1-3 are missing page numbers.
7-1	Table of Content (repeat)	Update the first Table of Contents and remove the duplicate on page 7-1 in the Overview section.	The location of the Table of Contents is inconsistent with the rest of the manual.
7-2	First heading	7. Solar Ready Requirements	The title of this chapter is inconsistent with other chapters which include "requirements" in the title. Suggest revising the title to include the word "Requirements".
7-3	7.2.1, paragraph 1, sentence 1-3	The solar ready requirements are applicable to newly constructed single family residences located in subdivisions with 10 or more residences ~~and where the application for a tentative subdivision map for the residences has been deemed complete by the enforcement agency on or after January 1, 2014.~~ This allowance is for situations where subdivisions may be partially built or where the layout of streets and residences have previously been approved by the enforcement agency. The allowance applies only to the solar ready requirements.	Sentence 2 and 3 refer to an "allowance" which seems to have been deleted from the previous sentence. Suggest revising to clarify when the Solar Ready Requirements apply to existing sub-divisions.
7-6	G. 2. a.	Install a dishwasher that meets or exceeds the ENERGY STAR	Wording revised for clarity.

Page	Paragraph/Section	Suggested Revision	Comments
		Program requirements and install either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or	
7-7	7.3.1.2 Exceptions B, 1st sentence	Buildings are exempt from solar zone, interconnection pathway and documentation requirements if a domestic solar water-heating system complying with §Section 150.1(c)8Biii is permanently installed at the time of construction.	The reference to Section 150.1(c)8Ciii is incorrect. The correct reference is Section 150.1(c)8Biii. *Note: There is also an error in the Standards.*
7-7	7.3.1.2 Exceptions C, last sentence	~~For a detailed discussion of annual solar access, see Exception 5 under Single Family Residences.~~	Exemption C references an exemption from the single family residences section that has been deleted. Suggest deleting the entire sentence.
7-8	2. a.	Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements and install either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or	Revise wording to clarify.
7-9	7.3.2, 2nd paragraph	If a solar zone is located on a low-sloped roof (ratio of rise to run less than or equal to 2:12), the orientation requirement does not apply.	Definition of low-sloped roof is incomplete.
7-10	7.4.2, 1st sentence	All buildings that are required to meet the Solar Ready Requirements ~~a solar zone~~ must also include a plan for connecting a PV and SWH system to the building's electrical or plumbing system. The construction documents shall indicate:	Revise wording to clarify.
7-11	7.6, 1st sentence	Pursuant to regulations established by the Office of the State Fire Marshal, ~~the 2013 version of~~ Title 24 Parts 2, 2.5 and 9 of Title 24 ~~now~~ includes requirements for the	This sentence includes reference to 2013 versions of (assuming Title 24) Parts 2, 2.5 and 9. Suggest deleting "the 2013 versions of" and inserting "Title

Page	Paragraph/Section	Suggested Revision	Comments
		installation of rooftop solar photovoltaic systems.	24". Also delete the word "now" since it was included in earlier code.
7-15	7.7, item 2	This form is required when buildings comply with the solar ready requirement by including a solar zone. ~~That is, an appropriately sized solar PV system is not installed, an appropriately sized solar water heating system is not installed, the building does not comply with all the OCST and high efficacy lighting requirements or the roof is not designed for vehicle traffic or a heliport.~~	Suggest simplifying the description by deleting this sentence.

9. COMMENTS ON CHAPTER 8 – PERFORMANCE METHOD

Page	Paragraph/Section	Suggested Revision	Comments
8-1	1	The energy budget includes water heating, space heating, space cooling, and IAQ fan energy. Lighting energy is not included in the performance calculations because all residential lighting measures are mandatory and therefore not eligible to be traded-off using the performance method.	Explain why lighting isn't included.
8-1	2	Improved water heating system efficiency includes a wide range of equipment that can significantly increase efficiency along with improvements to the distribution system design, which can drastically reduce energy losses.	Recommend clarifying the reduced energy losses come from improving dist. system design.
8-2	Header	Correct header if getting rid of "What's new for 2013" section.	Recommend keeping this section if there are new requirements/ procedures related to the performance method for 2016?
8-3	2	For existing buildings where the values of currently installed features are unknown, default values may be used based on the year of the construction. Refer to the Default Assumption for Year Built, Table 8-1 below.	Clarify this applies to existing buildings and Table 8-1 is from the compliance manual.
8-3	7	The standard design uses the same roof/ceiling area, raised floor area, slab-on-grade area and perimeter as the proposed design but uses the standard insulation R-values required in the prescriptive package A.~~s.~~	No longer multiple prescriptive packages. We suggest updating language accordingly.
8-4	4	The principal report is the Certificate of Compliance (CF1R-PRF-01-E).	Specify which CF1R for performance projects.
8-4	5	The CF1R-PRF-01-E has two highly visible sections, one for special features	Specify the PRF01 is the CF1R being discussed.
8-4	9	1. Is a simplified input or assumption appropriate for a specific case? If	Should say increases compliance margin.

Page	Paragraph/Section	Suggested Revision	Comments
		simplification reduces the predicted energy use of the proposed building or ~~reduces~~ increases the compliance margin when compared to a more explicit and detailed modeling assumption, the simplification is not acceptable.	
8-6	4	Envelope, ~~and~~ HVAC equipment and outdoor lighting requirements for high-rise multifamily ~~apartments in~~ buildings ~~that are~~(four or more habitable stories) ~~(and hotels or motels of any number of stories)~~ are covered by the Nonresidential Energy Standards. These are explained in the Nonresidential Compliance Manual. Indoor lighting in dwelling units, and water heating requirements for high-rise multifamily buildings are covered under the Residential Energy Standards and this compliance manual. [Start new paragraph here] Low-rise ~~M~~multifamily ~~apartments in~~ buildings ~~that are~~ (one to three habitable stories) are covered by the Residential Energy Standards ~~for low-rise residential buildings,~~ which are covered in this manual. Compliance for a low-rise multifamily building may be demonstrated either for the building as a whole or on a unit-by-unit basis. Rental apartment buildings are usually modeled as a whole building. For multifamily buildings designed for dwelling units to be owner-occupied, the project developer may favor providing a separate, unique, Title 24 compliance report for each dwelling unit. Floors and walls between dwelling units are considered to have no heat transfer, and may be ignored in performance calculations.	Suggest restructuring paragraphs so High-rise multi-family is separate from Low-rise multi-family. Remove reference to hotel/ motel- these are not considered multi-family.
8-7	1	Thus, for the whole-building compliance approach in a multifamily building that has utilized a compliance option that requires HERS verification, the required energy compliance documentation for each dwelling unit should consist of a whole-building Certificate of Compliance (CF1R-PRF-01-E)	Specify the CF1R is the PRF-01
8-7	2	These HERS measures are excluded from	Sentence adds

Page	Paragraph/Section	Suggested Revision	Comments
		the whole-building compliance approach because they would require dwelling-specific data input into the compliance software. ~~The dwelling-specific data output from the compliance software must be shown on the Certificate of Compliance, because they cannot be properly documented using a single whole-building Certificate of Compliance.~~	unnecessary complexity.
8-7	3	The measures that cannot be utilized for the multifamily whole-building compliance approach, but can be ~~taken~~ used for credit when dwelling units are individually modeled ~~as follows~~include:	Clarify language
8-9	Example 8-2	Note: For multiple dwelling units that ~~is~~are identical in every way except orientation, a single multiple orientation report can ~~suffice or meet the~~be used to demonstrate compliance for ~~that~~ those units (see 8.4.3 below).	Clarify language
8-9	1	Another option for showing unit-by-unit compliance for a multifamily building is the multiple orientation alternative~~s~~.	Clarify language
8-9	2	The ~~computer~~ performance method may be used to demonstrate that a dwelling unit plan in a multifamily building complies regardless of how it is oriented.	Should just specify performance method.
8-11	1	The ~~computer~~ performance method may be used to demonstrate that a single family dwelling plan complies regardless of how it is oriented within the same climate zone.	Use performance instead of "computer"

10. COMMENTS ON CHAPTER 9 - ADDITIONS, ALTERATIONS AND REPAIRS

Page	Paragraph/Section	Suggested Revision	Comments
9-1	2nd paragraph from bottom	Whenever additions and alterations trigger mandatory measures - whether envelope, mechanical, water heating, indoor lighting or outdoor lighting - the Certificate of Compliance and the Mandatory Measures Summary must be submitted with the permit documentation and included in the building plans.	CF1R forms are not really necessary for some limited work scopes.
9-3	9.1.3 4th paragraph	Examples of work considered repairs include: 1. Replacing a broken pane of glass, but not replacing the entire window; 2. Uninstalling ~~When~~ fenestration and other envelope components ~~are uninstalled~~ for maintenance or repair purposes and then reinstalling the same fenestration or other envelope components ~~are re-installed~~ in the same location~~; this is considered a repair;~~ ~~3. When any existing envelope component is moved to a new location (even when that location partially overlaps the item's previous location), the work is considered an alteration;~~ ~~4~~3. Replacing a failed fan motor or gas valve in a furnace but not replacing the entire furnace; ~~5~~4. Replacing a heating element in a water heater but not replacing the entire water heater. Note that when any existing envelope component is moved to a new location (even when that location partially overlaps the item's previous location), the work is considered an alteration. ~~Note, t~~Also note that some replacements of ~~some~~ HVAC components for repair purposes are defined by the Standards as alterations …	Numbered bullets listed under "Examples of work considered repairs include:" are not all repairs, and they don't all have parallel sentence structure. Propose reorganizing the section so that the numbered bullets are all examples of repairs, and making bullet 2 have the same sentence structure as the other bullets. Also, there is a grammar error (verb doesn't match sentence subject) in the first sentence of the last paragraph.
9-4 through 9-5	Example 9-2	Question An existing duplex is remodeled, which includes only the installation of new faucets	Answer as written doesn't directly answer the question.

Page	Paragraph/Section	Suggested Revision	Comments
		and bathroom lighting. Do the Energy Standards apply? Answer Yes, ~~This is an alteration since no new conditioned space is being created,~~ the remodel is considered an alteration, but due to the limited scope of work it only must comply with the applicable mandatory measures described in §110.1 for appliances and §150.0(k) for residential lighting.	Also should clarify that in this situation, the only compliance requirements are the applicable mandatory measures.
9-5	Example 9-3 Answer	Example 9-3 … Answer Since floor area is being added but not conditioned volume, this is an alteration and not an addition. It will need to comply with Title 24 using either the prescriptive or performance method, and it will need to meet all applicable mandatory measures. To comply prescriptively, the new~~New~~ and replacement windows must meet the maximum U-factor and SHGC ~~prescriptive~~ requirements of §150.2(b)1. This may be done by area-weighted averaging. All ~~Newly~~ the new and replacement ~~installed~~ windows must also comply with the mandatory measures for caulking/sealing around windows per §110.7, as well as the mandatory maximum U-factor requirements in §150.0(q). In alterations, it is recommended to install insulation in the exposed walls if no insulation was found when the walls were opened; for 2x4 wood framing install the mandatory minimum R-13 and for 2x6 wood framing install the mandatory minimum R-19 per §150.0(c). Alternatively for this example, if both wall insulation and windows are being altered, the existing plus alteration performance approach may be used to demonstrate compliance for ~~overall building (~~the ~~entire~~ whole house~~)~~ even if individual altered windows fail to meet the prescriptive requirements~~, as long as the building meets all applicable mandatory~~	Need to make clearer what is mandatory versus prescriptive versus performance method. The section on the Existing + Alteration performance method needs updating to match the requirement that there must be at least two altered components. Also proposing other clarifying edits.

Page	Paragraph/Section	Suggested Revision	Comments
		~~requirements.~~ The advantage of using the existing plus alteration approach is that it allows energy trade-offs between different building components, as long as the building meets all applicable mandatory requirements. ~~At this time, since the exterior walls are exposed or open, this allows the opportunity to insulate the walls and contribute the ability to meet energy compliance; otherwise it would be difficult to comply with overall building compliance.~~	
9-9	9.2.4	Need to delete Section 9.2.4, because it does not match the Section 9.2 "What's New" in the 2016 Standards topic.	Section 9.2 is supposed to cover "What's New" in the 2016 Standards, but everything shown in the newly numbered Section 9.2.4 is in the 2013 Standards.
9-9	9.3 Paragraph 2 First sentence	There are a number of different compliance alternatives or compliance paths to demonstrate that an addition or alteration meets the Energy Standards. …	Minor typo
9-11	9.3.1.1 4 numbered bullets at the top of page	1. Additions ~~of <~~ ≤ 300 ft2: Do not require a cool roof to be installed; 2. Additions ≤ 400 ft2: Total glazing area up to 75 ft2 or 30% of the conditioned floor area, whichever is greater; and up to 60 ft2 of West-facing glazing area; roof and ceiling insulation need not exceed §150.0 mandatory minimums; and extensions of existing wood frame exterior walls may keep the same dimensions and require R-15 at 2x4 walls and R-19 at 2x6 walls~~; wall insulation of R-13 is acceptable;~~ 3. Additions > 400 ft2 and ≤ 700 ft2: Total glazing area up to 120 ft2 or 25% of the conditioned floor area, whichever is greater; up to 60 ft2 of West-facing glazing area; roof and ceiling insulation need not exceed §150.0 mandatory minimums; and ~~need not exceed R-13 insulation in~~extensions of existing wood frame exterior walls may keep the same dimensions and require R-15 at 2x4 walls and	This section has not been fully updated to match changes to the 2016 Standards.

Page	Paragraph/Section	Suggested Revision	Comments
		R-19 at 2x6 walls; 4. Additions > 700 ft2: Total glazing area up to 175 ft2 or 20% of the conditioned floor area, whichever is greater; and up to 70 ft2 of West-facing Glazing area; and extensions of existing wood frame exterior walls may keep the same dimensions and require R-15 at 2x4 walls and R-19 at 2x6 walls.	
9-11	Section 9.3.1.2 Bullet "B"	B. Existing + Addition as New Construction Demonstrating compliance by combining existing plus addition as all new construction is another approach. This approach ~~is~~ may be used when the addition does not comply on its own. Compliance can be hard to achieve because all existing features would already have to ~~be brought up to~~ current code. If the existing building will be altered, then the existing plus addition plus alteration method explained below is another option.	Once you start upgrading the existing house the project would become an existing + addition + alteration, so you wouldn't need to model it as new construction.
9-11	9.3.2.1 1st sentence in 1st paragraph	Alterations may comply prescriptively by meeting all applicable requirements in §150.2(b) which are explained further in Section ~~9.5.1~~9.6 and summarized in Tables 9-5~~A~~ and ~~9-5B~~9-9.	Table and Section references need updating. This will have to be revisited for the whole manual after all edits are incorporated.
9-12	9.3.2.2 1st paragraph	Alterations may comply using the performance approach by meeting the requirements in §150.2(b)2. This is explained in Section ~~9.6.2~~9.7, and summarized in Table 9-1.	Section reference needs updating. This will have to be revisited for the whole manual after all edits are incorporated.
9-15	9.4.1.3 First Paragraph	… if the overall alterations meet the Energy Standards with the prescriptive or performance approach (see Section~~s~~ 9.6).	Typo
9-15	9.4.1.41st paragraph	Greenhouse or garden windows are special windows that project from the façade of the building. ~~It is~~They are typically ~~a~~ five sided structures. NFRC-rated U-factors for greenhouse windows are typically comparatively high and may not meet the mandatory maximum U-factor ~~requirements~~ of 0.58.	Grammar problem: Subject and verb mismatches

Page	Paragraph/Section	Suggested Revision	Comments
9-15	9.4.1.4 Paragraphs 2 and 3	For new buildings and additions, §150.0(q) includes an exception from the U-factor requirement for dual-glazed greenhouse or garden windows that total up to 30 ft² of fenestration area. For additions with over 30 ft² of greenhouse and garden windows ~~included in additions~~, the area-weighted average for all new and replacement fenestration must be used to show that the combined average U-factor complies with the U-factor requirement.	Standards §150.2(a) states that additions have to meet §150.0(q) the same as new buildings, so that would include Exception 1 to §150.0(q)1 regarding greenhouse windows.
9-15	9.4.1.4 3rd paragraph	… the area-weighted average for all new and replacement fenestration must be used to show that the combined average U-factor complies with the U-factor requirement.	Is the highlighted statement correct, or would you do the area-weighting excluding the exempt 30 ft^2?
9-19	Example 9-7 Answer	The 2016 Energy Standards now allow the installation of Joint Appendix JA8~~JA 8~~ compliant lamps in screw-based fixtures as a way to comply with the high efficacy lighting requirements.	Suggested clarifying edit.
9-20 to 9-21	9.5.1 A. Bullet 3	All prescriptive Package A requirements must be met, unless otherwise noted below: 3. Extensions of existing wood frame walls may retain the dimensions of the existing walls and require the following cavity~~Required exterior wall~~ insulation: In 2x4 wood frame walls, insulation shall be R-~~13~~ 15~~or an overall construction assembly U-factor ≤ 0.102, for wood or metal frame walls~~; In 2x6 or greater wood frame walls, insulation shall be R-19~~ or an overall construction assembly U-factor ≤ 0.074, for wood or metal frame walls~~;	Wall insulation information has not been updated to 2016 Standards.
9-21	9.5.1 A. Bullet 5	All prescriptive Package A requirements must be met, unless otherwise noted below: 5. Only mandatory minimum roof~~Roof~~ and ceiling insulation ~~requirements~~required.	Clarify language.
9-21	9.5.1	All prescriptive Package A requirements must	Wall insulation information has not

Page	Paragraph/Section	Suggested Revision	Comments
	B. Bullet 3	be met, unless otherwise noted below: 3. Extensions of existing wood frame walls may retain the dimensions of the existing walls and require the following cavity insulation:~~Required exterior wall insulation:~~ In 2x4 wood frame walls, insulation shall be ~~R-13 or an overall construction assembly U-factor ≤ 0.102, for wood or metal frame walls~~; In 2x6 or greater wood frame walls, insulation shall be R-19~~ or an overall construction assembly U-factor ≤ 0.074, for wood or metal frame walls~~;	been updated to 2016 Standards.
9-21	Section 9.5.1 B. Bullet 5	5. Only mandatory minimum ~~Roof~~roof and ceiling insulation ~~requirements~~required.	Clarify language
9-21	9.5.1 C. Bullet 6	All prescriptive Package A requirements must be met, unless otherwise noted below: ~~6. If the addition has a floor area >700 ft² and ≤ 1,000 ft², all requirements of Package A apply except the West-Facing Glazing Area may be allow up to 70 ft² for additions up to 1,400 ft² (since 70 ft² is 5% of 1,400 ft²). See §150.2(a)1A.~~	Bullet 6 seems to repeat information in the other bullets. We think it should be deleted.
9-21	9.5.1 C.	6. Extensions of existing wood frame walls may retain the dimensions of the existing walls and require the following cavity insulation: In 2x4 wood frame walls, insulation shall be R-15; In 2x6 or greater wood frame walls, insulation shall be R-19.	Need to add a numbered bullet for new 2016 Standards wall insulation information.
9-22	Figure 9-2 –Text on the upper right side of graphic	Insulation requirements from Package A~~:~~, except wood frame extensions of existing wood frame walls may keep the same dimensions and install ~~unless addition is 700 ft2 or less, then R-13~~R-15 for 2x4 walls and R-19 for 2x6 or greater walls; and ~~is acceptable for wood frame.~~ mandatory minimum roof/ceiling insulation is allowed for additions 700 ft2 or less.	Roof/ceiling and wall insulation information has not been updated to 2016 Standards.

Page	Paragraph/Section	Suggested Revision	Comments
9-22	9.5.2 1st Paragraph	The permit applicant must submit a completed version of the Certificate of Compliance, CF1R-ADD form, for prescriptive additions when less than ~~100~~ 1,000 ft2.	Addition area should be 1,000 ft2, not 100 ft2.
9-24	Table 9-3A	Change: "No requirements" to "Mandatory requirements from §150.0(a)"	Need to reference Mandatory requirements.
9-25	Table 9-3D: 1st row after headings	Change "Exterior Wall Insulation" to "Exterior Framed Wall Insulation" Change requirements for all additions to: Package A: CZ 1-5, 8-16: U=0.051 CZ 6, 7: U=0.065 except extensions to existing wood frame walls may maintain same dimensions plus cavity insulation: In 2x4 Wood Framing: R-15 In 2x6 Wood Framing: R-19	Need to update for 2016 Standards
9-25	Table 9-3D: 2nd row after headings	Change requirements for all additions: Package A: All CZs: R-19 / U=0.037 ~~or equivalent U-factor~~	Need to update U-factor for 2016 Standards
9-27	Section 9.5.4, numbered bullets 1 and 2	Update bullets 1 and 2 so they match the requirements in the 2016 code.	The prescriptive requirements for additional water heaters in 150.1(c) 8 have changed in the 2016 code, so this section needs to be updated.
9-27	Example 9-9	Question: A small addition of 75 ft² is being planned for a house located in climate zone 7. An existing porch off the master bedroom is being enclosed, and new 2x4 wood frame walls are being extended from the 2x4 walls of the existing house. The existing heating and air conditioning system will serve the new conditioned space including an extension of less than 40 linear feet of new ducts. The contractor wants to follow the prescriptive requirements. What requirements apply?	Need to update wall and ceiling insulation references to 2016 Standards.

Page	Paragraph/Section	Suggested Revision	Comments
		Answer: Since the addition is smaller than 400 ft², the total fenestration area is limited to a maximum of 75 ft² and west-facing fenestration area is limited to 60 ft². The fenestration must meet the U-factor and SHGC requirements of Package A. For climate zone 7, these fenestration requirements are a maximum U-factor of 0.32 and a maximum SHGC of 0.25. For an addition of this size, insulation only must meet the mandatory requirements of R-~~30~~ 22 ceiling insulation; ~~R-13 wall insulation~~ and R-19 floor insulation. The new 2x4 walls are extensions of existing 2x4 walls, so they only need R-15 cavity insulation. Since the addition is also less than 300 ft2, there is no cool roof requirement.	
9-29 to 9-30		Answer For Title 24 energy compliance calculations, the area used for greenhouse windows is the rough opening in the wall. Not many greenhouse windows meet the mandatory maximum fenestration U-factor of 0.58 or the prescriptive addition or alteration U-factors or SHGCs on their own. The default U-factor for a dual pane metal frame greenhouse window from Table 110.6-A is 1.40, while the default SHGC from Table 110.6-B assuming fixed clear glass is 0.73. By comparison, fenestration in prescriptive additions has to meet the Package A U-factor of 0.32 for all climate zones, and an SHGC of 0.25 in all climate zones except 1, 3 and 5 which have no SHGC requirement. However, there are several options and exceptions available in the Standards. For alterations, Exception 1 to Section 150.2(b) allows any dual pane greenhouse windows ~~in alterations, they must also~~to meet the prescriptive U-factor ~~and SHGC~~ requirements of Package A~~,~~. This makes it possible for greenhouse windows to comply with Title 24 as part of a prescriptive alteration, if the proposed product also meets the prescriptive SHGC requirement either by itself or when area-weighted with all of the	Question asks about greenhouse windows, but answer includes both greenhouse windows and skylights. Propose removing the references to skylights in the answer. Need to revise information on greenhouse windows per 2016 code.

Page	Paragraph/Section	Suggested Revision	Comments
	Example 9-12: Answer (continued on next page)	new and replacement fenestration in the project. ~~however, not many greenhouses can meet the new efficiency prescriptive requirements. In the performance approach, any dual-glazed greenhouse or garden window installed as part of an alteration complies with the U-factor requirements, §150.1(b)1B.~~ The existing plus alteration performance method may also be considered if at least one other component of the building will be upgraded in addition to the fenestration. For new construction and additions, Exception 2 to Section 150.0(q) exempts up to 30 ft2 of dual pane greenhouse windows from the mandatory maximum U-factor of 0.58. This allows additions with up to 30 ft2 of dual pane greenhouse windows to demonstrate Title 24 energy compliance using the performance approach, even if the greenhouse windows' actual NRFC-rated or default U-values are greater than 0.58. Compliance in that case would depend on higher than average energy efficiency for some other components of the project to offset the poor performance of the greenhouse windows. Prescriptive addition compliance is also an option if the ~~Alternatively, Greenhouse~~ greenhouse windows ~~can also~~ meet the prescriptive maximum area-weighted average U-factor and SHGC in combination with other new and replacement fenestration in the project. ~~in §150.0(q) with the Exception of up to 10 ft²square feet or 0.5% of conditioned floor area, whichever is greater is allowed. Note For greenhouse windows, the window area is the rough opening.~~ ~~However, the SHGC for greenhouse windows must meet the requirements shown in the prescriptive Package A, or must meet the SHGC used to show compliance in the performance approach.~~ Greenhouse windows may use one of three methods for determining the proposed SHGC: NFRC rated SHGC; or Default SHGC from Table 110.6-B; or If site-built greenhouse windows, then $SHGC_T$	

Page	Paragraph/Section	Suggested Revision	Comments
	Example 9-12: Answer (continued from previous page)	can be calculated from the manufacturer's center of glass SHGC (SHGCc) and using the following equation: $SHGC_T = 0.08 + (0.86 \times SHGC_C)$. See Reference Appendix NA6.1 for more requirements for using this method. Comparable methods are available for determining U-factors. ~~To meet the SHGC for greenhouse windows, the proposed fenestration may use the NFRC rated SHGC or the default SHGC from Energy Standards §Table 110.6-B, if the area weighted average SHGC of the greenhouse window plus other fenestration in the proposed design meets the values used for compliance is also allowed.~~ ~~For skylights, Exception to §150.1(c)3A, exempts up to two square foot of tubular skylights from the U-factor requirements, provided that the ceiling diffusers are dual-paned; and any additional skylights must meet the U-factor requirements. Skylights may use one of three methods for determining the proposed SHGC:~~ ~~NFRC rated SHGC; or~~ ~~Default SHGC from §Table 110.6-B; or~~ ~~If site-built greenhousethen SHGCfen can be calculated from the manufacturer's center of glass SHGC (SHGCc) and using the following equation: SHGCfen = 0.08 + 0.86 x .~~	
9-30	Section 9.5.5, last paragraph before Section 9.5.5.1	To learn more about what kinds of alterations are assigned energy credit using the Existing + Addition + Alterations performance approach, see ~~Section 9.5.2~~ Table 9-4.	Need to update section reference in text.
9-31	Section 9.5.5.2, numbered bullet 3	3. Existing Components to be Altered or Replaced~~, "Altered"~~ without HERS verification: Each altered component (i.e. a new component which replaces an existing component) is modeled and tagged within the performance compliance program as ~~"altered". Each component or system which remains is modeled and tagged within the compliance software as~~ "Altered". No verification of existing conditions is required in this compliance path; therefore, no "Existing" (pre-alteration) conditions are specified. ~~such~~	Edited language to eliminate repetition and clarify.

Page	Paragraph/Section	Suggested Revision	Comments
		~~as~~ For example, in this method a new water heater that replaces an existing water heater would be labeled "altered", but no information would be modeled for the existing water heater being replaced.~~;~~ Note that a new water heater that is added to supplement an existing water heater to remain would be labeled "new", not "altered". This method can be used for alterations to building construction assemblies and fenestration types, as well as replacement HVAC and water heating systems, and improved building leakage. ~~Also, new mechanical equipment that does not replace existing mechanical equipment would be tagged as "new". No verification of existing conditions is required in this compliance path; therefore, no "Existing" (pre-alteration) conditions are specified.~~	
9-31	Sections 9.5.5.2 and 9.5.5.3, beginning with the last paragraph of 9.5.5.2	4. Existing to be Removed: Existing roof/ceilings to be removed as part of the permitted work, plus any skylights within those removed roof/ceilings, are excluded from the model (i.e., they are completely omitted from the calculations); exterior walls to be removed, and all fenestration areas in those removed walls, are not modeled; and raised floors and slab-on-grade floors to be removed are also omitted. Note: Portions of new fenestration including skylights that will occur in the existing opening of fenestration to be replaced are tagged "altered". Portions of new fenestration that will occur where there is no existing fenestration opening are labeled as "new". ~~9.5.5.3 Existing to be Removed:~~ ~~Existing roof/ceilings to be removed as part of the permitted work, plus any skylights within those removed roof/ceilings, are excluded from the model (i.e., they are completely omitted from the calculations); exterior walls to be removed, and all fenestration areas in those removed walls, are not modeled; and raised floors and slab-on-grade floors to be removed are also omitted.~~	The first paragraph of current Section 9.5.5.3 should be numbered bullet 4 of Section 9.5.5.2, not the beginning of its own section. The rest of current Section 9.5.5.3, through the line that reads "Refer to Table 9-4 for a summary of E+A+A modeling rules" is the end of Section 9.5.5.2. This will change the numbering for the rest of the subsections to 9.5.5. Suggested edit to the Add sentence to the "Advantages"

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		Advantages: Does not require HERS verification of existing features to be altered. Energy improvements to the existing building that go beyond the Standard Design levels are an energy credit that can be effectively "traded" against features of the addition that are less energy efficient than required by the prescriptive levels that set the Standard Design for the addition alone. For example, an addition with a large glazing area may comply by replacing the existing HVAC system with high-efficiency equipment. Disadvantages: Detailed plans and other information on the existing building may be difficult to document and obtain. The E+A+A analysis may be relatively complex and time-consuming. Refer to Table 9-4 for a summary of E+A+A modeling rules.	paragraph for clarification.
9-32	Section 9.5.5.4, numbered bullet 3	3. **HERS-verified Existing Components to be Altered or Replaced:** ~~"Existing to be Altered:~~ The first step needed to use this method is to select "HERS verification of existing conditions" within the compliance software for any existing conditions that will be HERS-verified. This unlocks software inputs for both the "existing" and "altered" characteristics for those particular building features. The compliance software will not give the option to enter the pre-altered existing conditions, if you do not specify that the existing conditions will be HERS-verified. Each altered component (i.e. a new component which replaces an existing component) is modeled and tagged within the performance compliance program as "altered". ~~Each~~ The corresponding HERS-verified existing component or system ~~which remains~~to be changed is modeled and tagged within the same entry in the compliance software as "~~Altered~~Existing". For example, if existing, HERS-verified single pane metal frame windows will be replaced with NFRC-rated dual pane low-e wood frame windows with values that exceed the prescriptive requirements, the first step to	Bullet 3 looks as though it was copied from the earlier section on E+A+A without HERS verification.

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		receiving the maximum energy credit for that upgrade is to identify those existing windows as a feature to be HERS-verified. Then each altered window input would include both "existing" and "altered" window types. ~~such as, a new water heater that replaces an existing water heater would be labeled "altered"; a new water heater that is added to supplement an existing water heater would be labeled "new". Also, new mechanical equipment that does not replace existing mechanical equipment would be tagged as "new". No verification of existing conditions is required in this compliance path; therefore, the "Existing" (pre-alteration) conditions must be specified.~~ Note that any window area in addition to that being replaced would be labeled "new", not "altered". This method can be used for alterations to building construction assemblies and fenestration types, as well as some other building features.	
9-32	Section 9.5.5.4, numbered bullets 4, 5 and 6	Need to fix the formatting of the text. Numbered bullet 4 should go with "Removed Surfaces". Numbered bullet 5 "Advantages" and 6 "Disadvantages" should just be regular paragraphs as in the previous section.	Numbered bullet 4 should go with "Removed Surfaces". Numbered bullets 5 and 6 should be regular paragraphs.
9-32 to 9-33	Last paragraph	~~6.~~ **Disadvantages:** Detailed plans and other information on the existing building may be difficult to document and obtain. The E+A+A analysis may be relatively complex and time-consuming. A third party verification must be conducted of ~~all~~ selected existing conditions to be altered prior to construction, and that verification must be registered online with a HERS provider prior to permit submittal.	Need to clarify that HERS verification is only needed for existing features being altered, not for all existing features.
9-34	Section 9.6, 1st two paragraphs	Need to update section numbers to match revised content in sections.	Section numbers do not match revised text, both here and elsewhere in chapter 9
9-35	Table 9-5A, Column for	Ceiling w/ Attic: R-19, U=0.054	See Exception 2 to

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	mandatory measures, 1st cell under headings "Ceiling w/attic…"	§150.0(a) Exception: Where the attic space is not large enough to accommodate R-19, attic space shall be filled with insulation. See Exception 2 to §150.2(b) for details.	Section 150.2(b)
9-35	Section 9.6.2, numbered bullet 2	Need to delete numbered bullet 2 relating to replacing roof sheathing because there is no longer anything in the standards about that particular situation. See added comments below.	2013 Standards reference to replacing an entire roof has been removed from the 2016 Standards.
9-35	Table 9-5A, Row labeled "Replacing Roof Sheathing"	~~When the entire roof, including the decking of the dwelling is replaced, applicable requirements of Section 150.1(c)1A shall be complied with.~~	The text regarding roof sheathing from the 2013 Standards Section 150.2(b)1H has been deleted in the 2016 Standards Unless there have been other changes to the Standards since the 15-day language, the only prescriptive roof requirements given for alterations are in Section 150.2(b)1 relating to mandatory measures and Section 150.2(b)1H regarding replacing the exterior surface of the roof.
9-35	Table 9-5A, Column for mandatory measures, 2nd cell under headings "Roof Rafters:"	Roof Rafters: R-19, U=~~0.056~~ 0.054 §150.0(a)	Altered rafter roof U-factor <=0.054 per Exception to Section 150.0(a)1
9-36	Table 9-5A, Row labeled "Replacing Entire Roof, including sheathing" columns 3 and 5 regarding prescriptive requirements	~~When the entire roof, including the decking of the dwelling is replaced, applicable requirements of Section 150.1(c)1A shall be complied with.~~	The text regarding roof sheathing from the 2013 Standards Section 150.2(b)1H has been deleted in the 2016 Standards Unless there have been other changes to

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			the Standards since the 15-day language, the only prescriptive roof requirements given for alterations are in Section 150.2(b)1 relating to mandatory measures and Section 150.2(b)1H regarding replacing the exterior surface of the roof.
9-37	Table 9-5A, 2nd row on page, labeled "Replacing Vertical Fenestration…" and 3rd row on page labeled "Adding Vertical Fenestration …"	Both of these rows need to be updated to account for this change to the 2016 Standards.	Need to update table to account for **EXCEPTION 1 to Section 150.2(b):** Any dual-glazed greenhouse or garden window installed as part of an alteration complies with the U-factor requirements in Section 150.1(c)3.
9-37	Table 9-5A, Note 1	1: Alterations must comply with all applicable mandatory measures in §110.0 and §150.0 of the Energy Standards as explained in Chapters 3, 4, 5 and 6 of this Manual, except as noted in §150.2(b).	Text should note the exceptions for mandatory measures.
9-38	Section 9.6.2.3, Title of Section	9.6.2.3 Replacing the Roof Surface ~~or Roof Sheathing~~	Change title of section to eliminate reference to roof sheathing.
9-39	Section 9.6.2.3, C. Roof Sheathing	Delete Section 9.6.2.3 C. Roof Sheathing	The following text regarding roof sheathing from the 2013 Standards Section 150.2(b)1H has been deleted in the 2016 Standards: "When the entire roof, including the decking of the dwelling is replaced, applicable requirements of Section 150.1(c)1A shall be complied

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			with." None of the roof alteration sections of the 2016 code require compliance with Section 150.1(c)1A, so this section needs to be deleted.
9-39	Section 9.6.2.4 Replacement Fenestration, 1st sentence	~~If a~~Any fenestration (i.e. windows, skylights, clerestories, and glazed doors) that is being removed and replaced in an exterior wall or roof~~, it~~ is considered "replacement fenestration".	Grammar problem
9-40	Example 9-15: Question and 1st two paragraphs of Answer	Question An existing house in Climate Zone 12 has all single-pane windows. All of the windows (300 ft^2 total) will be replaced within existing openings, except a pair of 40 ft2 French doors ~~to~~ will replace ~~an~~ one existing 30 ft2 window. What requirements apply? Answer For prescriptive compliance, replacement fenestration (equal to or less than the area of existing windows in each wall being altered) and new additional fenestration area must both meet the U-factor (0.32) and SHGC (0.25) in Package A. There are only 10 ft2 of added fenestration, so the project meets Exception 1 to 150.2(b)1A and is not required to meet the ~~The post-alteration~~Package A total glazing area ~~must be no greater than~~ requirement.~~20% of conditioned floor area, and all~~ All installed fenestration also must meet applicable mandatory measures. In order to use the performance approach, ~~at~~ two or more energy measures must be used as a trade-off within the house per §150.2(b)2. The two altered components may be the same type, such as a trade-off between two or more windows, or different types such as replacing one window and a water heater. ~~For example, if the homeowner is replacing the 1) water heater along with 2) window replacements~~Once the project has at least two	Example should be revised to include: EXCEPTION 1 to Section 150.2(b)1A: Alterations that add fenestration area of up to 75 square feet shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C; And the 2016 change to the rules on performance method trade-offs: Section 150.2(b)2 Performance approach: NOTE: The altered components may be components of the same type, such as a tradeoff between two windows, or components of differing types, such as a tradeoff between a window and an amount of attic

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		altered components, then the Existing + Alterations calculation is available as a compliance alternative. In that case:	insulation.
9-41	Example 9-16 Answer	Since ~~only~~ more than two ~~the~~ windows are being replaced and can be traded-off against each other, this project can use the Existing + Alterations ~~all replacement windows must meet the requirements of Package A, and new~~performance method to demonstrate compliance. It also has the option of complying as a prescriptive alteration, if the new windows meet prescriptive requirements. New fenestration must also meet applicable mandatory measures of §110.6, §110.7 ~~0~~ and §150.0.	Need to update to 2016 code: Section 150.2(b)2 Performance approach: NOTE: The altered components may be components of the same type, such as a tradeoff between two windows, or components of differing types, such as a tradeoff between a window and an amount of attic insulation.
9-41	Example 9-17	This example needs to be updated to match the 2016 Standards.	Need to update to 2016 code: Exception 1 to Section 150.2(b) regarding greenhouse windows in alterations And: 150.2(b)2 Note allowing trade-off between two of the same type of components.
9-45 to 9-46	Examples 9-25 through 9-27	These examples need to be updated. See below for more details.	These examples need to be updated to the 2016 Standards because the water heating requirements have changed.
9-60	Example 9-31, 3rd sentence of Answer	Prescriptively, the new heating unit must also be a natural gas unit.	Need to check accuracy of this statement. Not clear why one could not replace a gas furnace with a comparably

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			efficient heat pump.
9-63 through 9-66	Tables 9-9 and 9-10	Review these two tables to see if they are both needed.	Tables seem almost identical, except with different page layout.
9-66	Section 9.7,1, 4th paragraph under titles	When there is no addition and only alterations to an existing building, this compliance path is allowed only when there are two or more altered components as stated in §150.2(b)2.	Need to update to 2016 code: Section 150.2(b)2 Performance approach: NOTE: The altered components may be components of the same type, such as a tradeoff between two windows, or components of differing types, such as a tradeoff between a window and an amount of attic insulation.
9-68	Example 9-39 Answer	The first step is to determine whether alterations to the existing building include at least two different energy components (e.g. upgrading attic insulation and replacing the water heater or replacing multiple windows in the house.) If so, use the E+A+A approach. If not, you're not allowed to use the performance approach.	Need to update to 2016 code: Section 150.2(b)2 Performance approach: NOTE: The altered components may be components of the same type, such as a tradeoff between two windows, or components of differing types, such as a tradeoff between a window and an amount of attic insulation.
9-70	Examples 9-44 and 9-45	These examples need to be updated to the 2016 Standards because the insulation requirements have changed.	These examples need to be updated to the 2016 Standards because the insulation requirements have changed.