

2016 Title 24 Code Change Advocacy

Request for Input:

Residential HVAC Field Verification and Diagnostics

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April 2014

Email Introduction

The California Investor Owned Utilities (IOUs) are actively supporting the California Energy Commission in updating the California Building Energy Efficiency Standards (Title 24). Their joint intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code change proposals for the 2016 code update and beyond. Through Codes and Standards Enhancement (CASE) Reports, the IOUs will provide the Energy Commission with the technical and cost-effectiveness information required to make informed judgments on proposed standards for promising energy efficiency design practices and technologies. This Request for Input provides an opportunity for stakeholders to help inform the development of these codes change proposals. The IOUs encourage participation in this step of the process through the submission of data— both primary sources and references to existing data, e.g., reports, spreadsheets, etc. Further opportunities to provide feedback regarding these code change proposals will follow this Request for Input.

How to submit responses:

Please submit responses to the questions presented below by Tuesday, May 13, 2014 to: info@title24stakeholders.com.

Summary of Potential Code Change Proposal

The Residential HVAC Field Verification and Diagnostics measure is intended to reduce inefficiencies in residential HVAC (heating, ventilation, and air conditioning) equipment by improving refrigerant charging and verification procedures, and air flow efficiency requirements.

Most residential air conditioners and heat pumps are split systems with an inside coil and an outside compressor bearing unit which are connected with refrigeration tubing. Systems are installed on-site without production line and manufacturing quality control. Though manufacturer's installation manuals instruct the technician how to safely and correctly assemble and then charge the system, many of the new air conditioners in California fail to achieve their rated efficiency due to improper amounts of refrigerant, improper evacuation, metering device malfunctions, and other problems. The impact of this degraded performance on the life cycle cost may be large statewide. The 2005, 2008, and 2013 Title 24 code cycles have required that refrigerant charge is done according to a superheat or subcooling protocol using generic tables which is then verified by a HERS rater. According to a 2012 study, technicians in the field may not understand how to test, diagnose, and repair faults properly.¹ These faults are often related to refrigerant charge. Laboratory work has shown the impact of refrigerant charge levels on energy efficiency can be significant.

¹ DNV KEMA, WO32 EM&V Interim Findings Memo for Commercial Quality Maintenance – Volume 1 - Field Observations, From WO32 EM&V Team to HVAC Project Coordination Group. August 14, 2013.

Modifications and additions are proposed for the 2013 update cycle to improve Title 24 requirements, including the following:

1. Modify charge indicator displays (CIDs) requirement to allow a broader range of devices installed with the system that can detect performance degradation.
2. Develop an exception to Section 150.1(c)7A and Section 150.2(b)1F to exempt single and multiple headed mini-split heat pumps that OEMs sell as a system (including refrigerant piping, charge, and terminal units) from refrigerant charge verification.
3. Modify the Appendix RA3.2.2. to allow manufacturer's installation instructions to be used instead of the generic charge tables for superheat and subcooling.
4. Modify the Appendix RA3.2.2. to require that a liquid line filter/dryer be installed on all split systems.
5. Develop alternatives to verification of weigh-in charging that do not require a HERS rater to witness and verify.
6. If an AC system is installed in cold weather, explore whether the new registry developed for 2013 Title 24 allows refrigerant charge to be checked later when the weather is warm enough. Manufacturers' installation manuals are clear that installation is not complete until charge is checked when the weather is warm enough.
7. Explore the possibility of using the surface temperature only method of charge verification developed by PNNL.²
8. Propose reducing the 0.58 watts/cfm for new residential construction based on the USDOE Furnace Fan proceedings. Also consider requiring 400 cfm/ton airflow or more for new construction.
9. Explore adding a Section 150.2(b)1Fi(b) to exempt replacement (altered) space conditioning systems with a TXV from the 300 cfm/ton minimum airflow requirement.
10. For altered systems, explore the ramification of exempting them from refrigerant charge verification if a set of prescriptive requirements, such as having a TXV, are met.
11. Develop the scope of work to develop the lab and field data necessary for projected 2019 Title 24 modifications.

² Brambley, MR. Pacific Northwest National Laboratories (2009). PNNL-18891. A Novel, Low-Cost, Reduced-Sensor Approach for Providing Smart Remote Monitoring and Diagnostics for Packaged Air Conditioners and Heat Pumps. US DOE

Questions for Interested Parties

The CASE Team is requesting responses to the specific questions listed below regarding Residential HVAC Field Verification and Diagnostics in California. Answers to these questions will inform the cost-effectiveness analysis, energy savings estimates, environmental impacts, and market impacts that will be presented in CASE Reports. When appropriate please enter reports, product names, and web addresses that you deem important to this topic.

1. Please tell us about yourself. Check all that apply to your current job description:

- Home builder General contractor Framing contractor
 Insulation Contractor Stucco contractor Building products manufacturer or rep
 Building inspector Compliance documentation author
 Other (please describe): _____

2. What fraction of your business is in serving the California residential market?

3. What devices or components are you aware of that can continuously monitor air conditioning systems, detect faults or performance degradation, and report faults?

- a. How well do these work?
- b. How do they report faults and/or degradation in performance?
- c. Do they support a technician in properly charging the system? If so how?

4. What are the most common HVAC faults that you see on residential systems? How can an installed device or use of technician tools that detect faults or performance degradation result better operating equipment?

5. What tools or methods are you aware of that do not require taking refrigerant pressure readings to verify refrigerant charge?

6. Are mini-split single or multi-headed heat pumps verified of having proper charge by the manufacturer prior to shipment? How is the requirement for HERS verification met?

7. What percentage of split systems have a TXV? Is this the same for new construction and change-outs?

8. Do manufacturers typically ship split system AC with liquid line filter dryers? Do manufacturers require that a filter dryer be installed?

9. How often a liquid line filter is dryer installed?

10. When installing a split system, what instructions and training do you give field personnel on how to charge the system?

11. What instruction and training do you give your field personnel on how to verify that the charge is correct when the temperature is 60°F or above? What is your practice when the temperature is below 60°F?

12. What instruction and training do you give your field personnel on airflow for a system in new house?

13. Do the instructions and training on airflow change when changing-out an air handling system at on an existing house? Please describe.

14. Does the current HERS refrigerant charge verification process work? How could it be improved?

15. Do you use the HERS sample protocol? If so how often do you use it?
16. Do HERS Raters have appropriate background and equipment to verify refrigerant charge? If not what do your recommend be done?
17. Are there alternative methods of verifying weigh-in charging that do not require evacuating the refrigerant, as current HERS verification requires?
18. How often does HERS charge verification occur when outdoor air temperature is less than 55°F? When charge is verified when outdoor air temperatures are below 55°F, is it verified again after air temperatures are above 55°F?
19. How often is HERS charge verification rescheduled when outdoor air temperatures are less than 55°F?
20. When designing a duct system for new construction, what design criteria do you use? Please be as detailed as possible.
21. Are airflow and watts measured (W/cfm and cfm/ton)? If so how is it done? What is an average value and what are the lowest and highest numbers you or your field personnel have measured?
22. In a change out in an existing house how often does duct work need to be modified? What are the reasons for making modifications?