

Davis Field Inspector's Guide

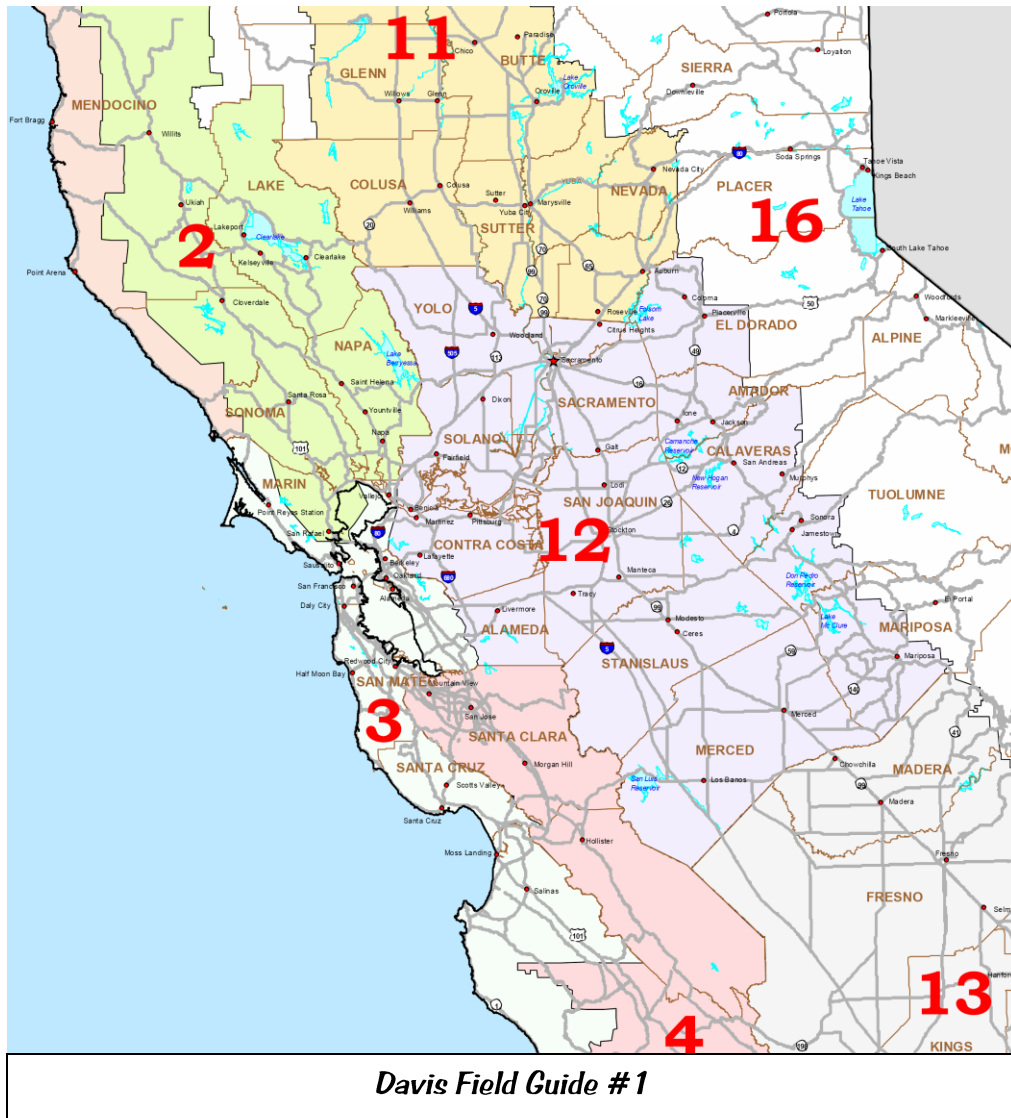
TO THE

2013 Energy Code

FOR PRESCRIPTIVE COMPLIANCE OF

HERS Required Measures

FOR RESIDENTIAL ALTERATIONS



Preface

The ***Davis Field Guide*** to the 2013 Energy Code for prescriptive compliance for HERS required measures for residential alterations is a guide for those who need to understand in laymen's language the new code that goes into effect ***for permits issued on or after July 1st, 2014***. This guide assumes you have a basic knowledge of the Title 24 code and with this knowledge we attempt to simplify the prescriptive requirements of which measures will be required and when. The information in this guide was taken from publications from the California Energy Commission and are deemed accurate at time of this publication. References from these publications will be noted when applicable. Since this is time sensitive material, if you have any questions about the code or any changes, call the energy hotline at the Energy Commission for any changes or clarifications at: ***1-800-772-3300***.

We have included a two page chart at the end of this guide as a quick reference summarizing the topics contained herein. We hope you enjoy and use this guide to simplify your life!

1

Simply put, there is one basic questions that must be answered to know if there is a HERS required measure for duct testing and sealing. If the answer is “no” you can stop right now---there is no HERS required measure for “DTS.” But there may still be a requirement for Refrigerant Charge and Airflow (see section 2).

Is there more than forty feet (40') of ductwork in unconditioned space?

If the answer is “yes” ---keep reading.

Duct sealing and testing is a mandatory measurement requirement in all climate zones. There is a refrigerant charge and airflow requirement in climate zones 2, 8-15. If you are lucky enough to be in a climate zone where both requirements are required (2, 8-15) you will have to do both HERS required measures.

Duct Sealing:

Let's start with the duct sealing and testing requirement. This information is found in the California Energy Commission Residential Compliance Manual, chapter 9 section 9.6 Alterations “Prescriptive Requirements”. We will also make reference to the 2013 Building Energy Efficiency Standards or “Standards”.

Alterations:

First, let's talk about an alteration or “HVAC changeout”.

“Existing duct systems must be sealed and verified by a HERS rater when portions of the heating and cooling system are altered. The requirement applies in all climate zones.

An air handler is installed or replaced.

Ducts must be sealed (as described below) under any of the following circumstances:

- 1. An outdoor condensing unit of a split system air conditioner or heat pump is installed or replaced;*

Duct Sealing

2. *A cooling or heating coil is installed or replaced;*
3. *More than 40 feet of new or replacement ducts are installed in unconditioned space”*

There are three options for showing compliance for existing duct systems listed below:

1. Total leakage is equal to or less than 15 percent of nominal system fan airflow.
2. Leakage to the outside is equal to or less than 10 percent of system fan airflow.
3. If the first option leakage target cannot be met, then compliance can be achieved by sealing all *accessible* leaks verified by a HERS rater inspection. **Sampling is not allowed.**

HERS field verification is required for all options listed above. For options 1 and 2, verification can be accomplished through sampling. For option 3, sampling is not allowed; a certified HERS rater must do the visual inspection and the smoke test on every house that chooses option 3. Procedures for sampling can be found in the Energy Commission’s publication “Reference Residential Appendices” in RA2. Procedures for duct testing, smoke test and visual inspection can be found in RA3.

When existing duct systems are constructed, insulated, or sealed with asbestos or any new extended ducts are added to a duct system insulated or sealed with asbestos, the ducts are exempt from the duct leakage and sealing requirements. Additionally, if a duct system has been previously certified by a HERS rater the duct system is exempt from the duct leakage and sealing requirements (unless more than 40’ of ductwork in unconditioned space has been added or replaced since the prior certification).

Entirely new or complete replacement duct system greater than 40 feet in unconditioned space:

The Energy Commission describes *entirely new or complete replacement duct system as:*

1. at least 75 percent of the duct material is new, and
2. any remaining components from the previous system are accessible and can be sealed.

Compliance for an entirely new or complete replacement duct system (>40'), leakage must be 6% or less and must be HERS verified. There is an exception if an existing air handler is installed (not replaced). If the 6% target cannot be met, a smoke test must be performed (and HERS verified, no sampling) to show that leakage is only coming from the air handler and all accessible leaks are sealed.

Note: Completely New or Replacement Duct Systems in *multifamily* dwelling units shall meet the 12% (total leakage protocol), or 6% (leakage to outside protocol) criteria used for newly constructed systems (may also use the smoke test protocol if the system does not meet these criteria). Otherwise, altered duct systems in multifamily dwelling units shall meet the 15% (total leakage protocol), or 10% (leakage to outside protocol), or smoke test criteria.

Entirely New or complete replacement space-conditioning system:

An *entirely new or complete replacement space conditioning system* installed in an existing dwelling includes:

1. the air handler and all of the system heating/cooling equipment (e.g. outdoor condensing unit and indoor cooling or heating coil for split systems; or complete replacement of a package unit),are new, and
2. *the duct system meets the definition of an Entirely New or Complete Replacement Duct System (including systems less than 40 feet in length*).*

* If ducted, entirely new or complete replacement space conditioning systems require duct testing regardless of duct length or location.

Compliance for an entirely new or complete replacement space-conditioning system, leakage must be 6% or less and must be HERS verified.

Accessible:

We see that the Energy Commission references the word “accessible”. They define accessible as:

“...having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions.”

Access is usually gained by opening a door, hatch, or other moveable panel. If this can be done without causing damage that would need to be repaired, this is considered accessible. It is not expected that drywall sections have to be cut or damaged to gain access.

Some judgment is required in determining if ducts are accessible or not. The local code enforcement agency will have the final say when it is not immediately obvious.

For example:

1. If the ducts are buried under insulation, and gaining access to the leaks in these ducts would require **substantially disturbing** the insulation and in effect greatly reducing the R value, this is probably not considered accessible;
2. If a leak in the duct system is in too small a space between framing members for an average size person to be able to reach the joint to seal it, then this is probably not considered accessible;
3. If ducts are suspended far above the ground and reaching them would require scaffolding or special equipment other than normal ladders, then these are probably not considered accessible;
4. If sheet metal ducts are wrapped with insulation and a smoke test indicates multiple small leaks along the lengthwise seams in the ducts in many locations, it is probably not cost effective to remove the insulation to find and seal these leaks. However, if one or more location shows a very obvious and substantial leak, it should be sealed.

2

Refrigerant Charge and Airflow:

This information is found in the Residential Compliance Manual, chapter 9 section 9.6 Alterations “Prescriptive Requirements”. We will also make reference to the 2013 Building Energy Efficiency Standards or “Standards”.

In climate zones 2, 8-15, when a refrigerant containing component of an air conditioner or heat pump is replaced or installed in an existing building, §150.2(b)1F requires systems that do not have a CID (Charge Indicator Display) installed to have refrigerant charge field verified by a HERS rater. This applies to air-cooled split systems, package units*, and mini-splits.

When return plenum measurements are necessary for compliance with refrigerant charge verification requirements (such as verifying superheat with no TXV installed), a 5/8 inch (16 mm) diameter hole shall be provided as shown in the Residential Appendices Figure RA3.2-1.

Measurement Access Hole (MAH) must be installed---with labels--- by the contractor and HERS verified. This is to allow the HERS rater a non-intrusive method to verify the return dry and wet-bulb temperature.

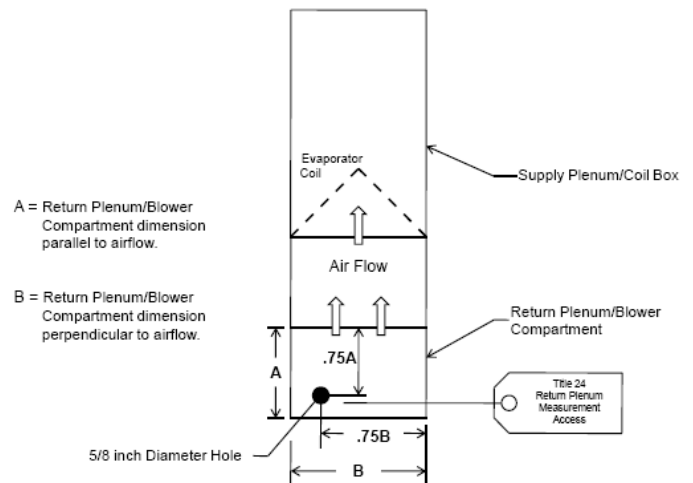


Figure RA3.2-1 Measurement Access Hole

Before you get too worried, let's break it down.

* Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to confirm refrigerant charge through field verification and diagnostic testing.

Alterations:

Besides a refrigerant charge measurement, the Standard 150.2(b)1F states:

“When a space-conditioning system is an air conditioner or heat pump that is altered by the installation or replacement of refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping, then any non-setback thermostats associated with the system shall be replaced with thermostats meeting the requirements of Section 110.2(c)” and meet the airflow requirements of RA3.

The airflow requirement is at least 300 cfm per nominal ton (RA3.2.2.7.2). This must be measured (plenum pressure matching, flow grid, or flow hood).

For example, a 3 ton condenser must have a minimum of 900 cfm of airflow.

Alternative to Refrigerant Charge and Verification requiring at least 300 cfm per ton of airflow.

If the altered HVAC that requires RC&V is not able to comply with the 300 cfm per ton of airflow required under subsection Reference Residential Appendix RA3.2.2.7.2, the HVAC installer may choose the alternative procedure outlined in Reference Residential Appendix RA3.2.2.7.3, Alternative to Compliance with Minimum System Airflow Requirements for Altered Systems, provided that the system thermostat is an **Occupant Controlled Smart Thermostat (OCST)** which conforms to the requirements of Reference Joint Appendix JA5.

Under RA3.2.2.7.3, installer must take a series of remedial steps, including but not limited to cleaning filters, removing obstructions from registers and dampers, replacing crushed or blocked ducts, cleaning the evaporator coil, making sure that the air handler is set to high speed and conforms to manufacturer specifications, and enlarging/adding the return duct and the return grill. These steps must be HERS verified by a HERS rater. Again, as mentioned above, when the installer chooses this option, the system thermostat must be an OCST.

Entirely new or complete replacement duct system:

Verified Cooling Airflow:

The airflow must be at least 350 cfm per nominal ton and be measured and verified by a HERS rater. This measurement can be done with plenum pressure matching, a flow grid device or a flow capture hood (traditional or powered). Refer to Residential Appendix RA3.

For example, a 5 ton system must have a minimum measured airflow of 1,750 cfm (5 times 350 equals 1,750).

Fan Watt Draw:

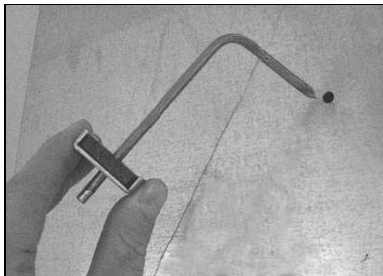
The actual measured (cfm) is multiplied by a factor of 0.58. That is the maximum fan watt draw that is allowed and must be HERS verified. Refer to Residential Appendix RA3.

For example, A 5 ton system has an actual measured airflow of 1825 cfm. Multiply 1,825 times 0.58. That is 1,058.5. If your measurement is equal to or below that, it is a pass.

As an alternative to the verified cooling airflow and fan watt draw, Tables 150.0-C and 150.0-D (return duct sizing and grill sizing) may be used instead.

Static Pressure Probe (Access):

Since cooling coil airflow must be measured, plenum pressure matching and flow grid methods require reading the static pressure off the supply plenum. The static pressure probe can either be permanently installed or the



contractor can drill an access hole for one—label it--- so the HERS rater can use a non-intrusive method to read the static pressure.

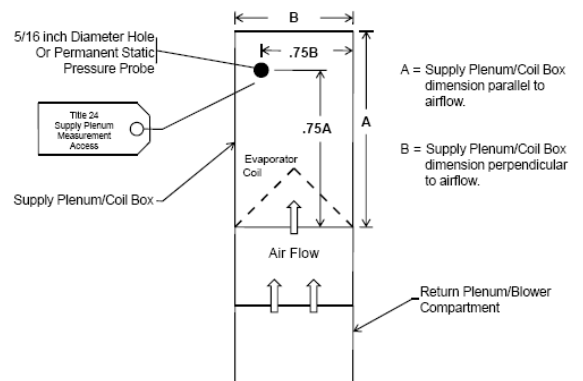


Figure RA3.3-1 Hole for the Placement of a Static Pressure Probe (HSPP) or Permanently Installed Static Pressure Probe (PSPP)

Final Note on Refrigerant Charge Measurement:

For a complete guide on how to perform the refrigerant charge and airflow measurement, please refer to the **Davis Field Inspector's Guide to the 2013 Energy Code for Prescriptive Compliance of Refrigerant Charge and Airflow for Residential Alterations**.

An installer is also allowed to perform a “weigh-in” method for compliance when outdoor temperatures are below 55 degrees F or if a standard charge measurement cannot be performed (some mini-splits). The enforcement agency (building department) may accept the installer's Certificate of Installation (CF2R-MCH-25c-H) to close out or “final” the permit with the certification from the installer that when a HERS verification is completed, if such verification demonstrates the refrigerant charge measurement does not pass, the installer, at no charge to the homeowner, will return and correct the charge (Residential Appendix RA2.4.4). A HERS rater may use the weigh-in method (below 55 degrees F) or use the standard charge measurement method. If the installer uses the weigh-in method (RA3.2.3.2), sampling is not allowed.

Unlike the duct sealing and testing requirement, the refrigerant charge requirement does not have a 40' duct length in unconditioned space rule. This HERS required measure must be performed regardless on the length of the duct system, in unconditioned space or not---it can be a ductless system as well. The installation of a charge indicator display (CID), if verified by a HERS rater, may be used as an alternative to the prescriptive requirement for HERS diagnostic testing of the refrigerant charge in system air conditioners and heat pumps. In other words, if a CID is installed, no refrigerant charge measurement is required---that is because the CID is a refrigerant charge measurement device! As of this publication, there is currently no CEC listed and approved residential CID on the market.

3

Required Documentation:

Contractor (or Homeowner) Forms:

CF1R-ALT-02

A registered Certificate of Compliance (CF1R- ALT-02) is required to issue a permit (be aware some enforcement agencies, at this time, may not be asking for them at time of permit issuance but it is required documentation prior to final). This document is provided by the contractor (or homeowner) stating what type of equipment is being installed, its minimum efficiency, and configuration. It also summarizes what HERS measures are required.

There are several Certificate of Installation (CF2R) forms that may be required.

CF2R-MCH-01b

The registered CF2R-MCH-01b is always required. It tells the homeowner, the enforcement agency and the HERS rater what equipment was actually installed, their efficiency and what HERS measures are required. The HERS rater checks this form against the CF1R- ALT-02 to confirm that the minimum efficiency has actually been installed.

CF2R-MCH-20

The contractor completes this duct leakage test form when a duct test is required. Variant:

d = standard duct test

e = duct test with smoke and sealing all accessible leaks

CF2R-MCH-22

The contractor completes this form for Fan Watt Draw Test. (Required for entirely new or complete replacement duct system in all climate zones or may use the alternative CF2R-MCH-28)

Variant:

a = all zones calling

CF2R-MCH-23

The contractor completes this form for compliance of the airflow requirement

Variant:

a = all zones calling

c = best that I can do (for altered duct systems that cannot meet 300 cfm/ton)

CF2R-MCH-25

The contractor completes this form for Refrigerant Charge Verification.

Variant:

a = superheat method

b = subcool method

c = weigh-in method

e = winter set-up method

f = factory charge package units certified by manufacturer (No HERS test required)

CF2R-MCH-28

The contractor completes this form for alternative to the airflow and fan watt draw requirement using table 150.0-C or 150.0-D. (Entirely new or complete replacement duct system in all climate zones as an alternative. Cannot be used for zonally controlled systems)

Rater forms:

CF3R-MCH-20, 22, 23, 25, 28

There are corresponding Certificate of Field Verification and Diagnostic Testing forms for all of the CF2Rs and are completed by a certified HERS Field Verification and Diagnostic Testing rater. These documents are created in a Provider's database registry and are generated with a unique registration number and digitally signed.

Final Note on Required Documentation:

All documents shall be registered through a Provider's registry and digitally signed.

2013 Energy Code Update

Effective July 1st, 2014

2013 Residential Compliance Manual (Prescriptive)			
Alterations and Repairs-HVAC			
Climate Zone	HERS Field Verification and Diagnostic Testing		
	Duct Sealing Verification (Altered ³ systems with >40' of ductwork in unconditioned space ⁴)	Refrigerant Charge and Airflow (300 cfm/ton) Measurement Access Hole (Altered ³ systems)	For Systems that have Cooling: Airflow (350 cfm/ton) Fan Watt Draw (0.58 w/cfm) Or Alternative Table 150.0-C or -D ⁵ Static Pressure Probe Access Air Filtration Requirement
1	Required	Not Required	Required For "Entirely New or Complete Replacement Duct Systems" ²
2		Required	
3 thru 7		Not Required	
8 thru 15		Required	
16		Not Required	

¹ Entirely New or Complete Replacement Space Conditioning System when: the air handler and all of the system heating/cooling equipment (e.g. outdoor condensing unit and indoor cooling or heating coil for split systems; or complete replacement of a package unit), are new, and *the duct system meets the definition of an Entirely New or Complete Replacement Duct System² (including systems less than 40 feet in length).*

² An entirely *new or complete replacement duct system* is at least 75 percent of the duct material is new, and any remaining components from the previous system are accessible and can be sealed.

³ A space -conditioning system is altered by the installation of or replacement of the air handler; an outdoor condensing unit of a split system air conditioner or heat pump is installed or replaced; a cooling or heating coil is installed or replaced; more than 40 feet of new or replacement ducts are installed in unconditioned space.

⁴ When >40' of ductwork is added, replaced or extended in unconditioned space, duct sealing and verification is required in all climate zones.

⁵ Table 150.0-C and 150.0-D (Return Duct Sizing and Grill Sizing minimums) can be used as an alternative to Airflow and Fan Watt Draw except Zonally controlled systems.



- A **Measurement Access Hole** provides a non-intrusive means for refrigerant charge verification by HERS raters and other third party inspectors, since it eliminates the need for the raters/inspectors to drill a hole into the installed air conditioning equipment enclosures for placement of the temperature sensor.

Residential Appendices 3.2.2.3

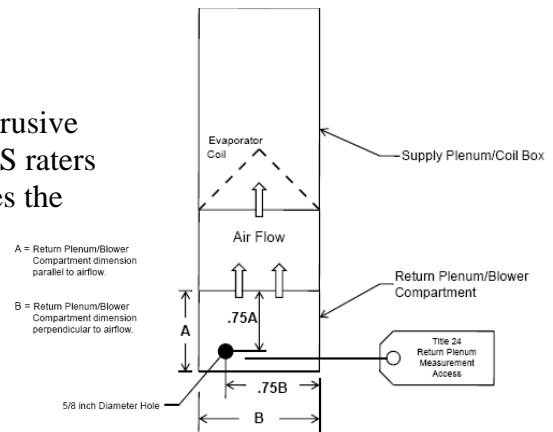


Figure RA3.2-1 Measurement Access Hole

For air-handling units with the return located entirely within conditioned space (such as when an up-flow air handler is mounted on a pedestal in a closet in the dwelling, or when the return grille is an integral part of the air-handling unit), the return plenum measurement access hole is not required, and in this case the return air temperature measurements shall be taken at the return grill when performing the procedures in RA3.2

- In the supply plenum there must be a hole provided by the installing contractor for the placement of a **Static Pressure Probe (HSPP)** or a permanently installed static pressure probe (**PSPP**), downstream of the evaporative coil. These are required in order to facilitate airflow measurement using devices/procedures that depend on supply plenum pressure measurements (i.e., plenum pressure matching and a flow grid).

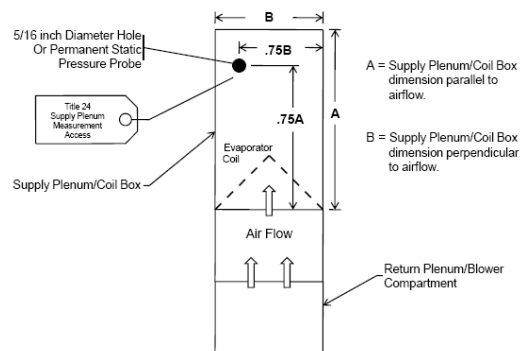
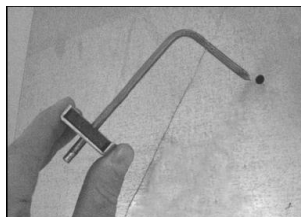


Figure RA3.3-1 Hole for the Placement of a Static Pressure Probe (HSPP) or Permanently Installed Static Pressure Probe (PSPP)



About the Author:

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Greg is the lead USERA HERS trainer and has been a Certified HERS Rater for many years. He has been a strong advocate for building performance and the Home Energy Rating System (HERS). He understands building performance from many different perspectives and has documented the meaningful value that energy efficiency adds through his experience in the Mortgage Finance and Home Improvement industries. Greg has used his diverse experience and developed the USERA HERS classroom and training materials. He has first-hand experience implementing the Title 24 Energy Efficiency Standards and understands the challenges building departments face in ensuring code compliance.



NOTES:

