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## 2. Compliance and Enforcement

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### 2.1 Overview

The local enforcement agency, typically associated with a city or county government, has primary responsibility for enforcing the California Energy Commission's *Building Energy Efficiency Standards* (Energy Standards). Low-rise residential buildings must obtain a permit from the local enforcement agency before a new building or addition is constructed and before alterations are made to existing buildings. Before a permit is issued, the local enforcement agency examines the plans, specifications and compliance documentation for the proposed building to verify compliance with all applicable codes and standards. The enforcement agency's plan check responsibility is to verify compliance with the Energy Standards, which is done by comparing the certificate of compliance (CF1R) with the plans and specifications for the building.

Once the enforcement agency determines that the proposed building (as represented in the plans and specifications) complies with all applicable codes and standards, a building permit may be issued. Once construction starts, the inspector verifies that the installed building components (HVAC equipment, fenestration, lighting, insulation, and so forth) match the CF1R. After construction is complete, the local enforcement agency performs the final inspection. If the building conforms to the plans and specifications approved during plan check, which includes all applicable certificates of installation (CF2R) and certificates of verification (CF3R).

The compliance and enforcement processes require participation from the architect or building designer, specialty engineers (mechanical, electrical, civil, and so forth), energy consultants, contractors, the owner, third-party inspectors (Home Energy Rating System [HERS] Raters), and others. This chapter describes the overall compliance and enforcement process and responsibilities throughout the permit process.

#### 2.1.1 Manufacturer Certification for Equipment, Products, and Devices

Certain equipment, products, and devices must be certified to the Energy Commission by the manufacturer that it meets requirements under Title 24, Part 6, and associated appendices. The Energy Commission makes no claim that the listed equipment, products, or devices meet the indicated requirements or, if tested, will confirm the indicated results. Inclusion on these lists only confirms only that a manufacturer certification has been submitted to and accepted by the Energy Commission. Additional information about the required information for manufacturers to certify products and for lists of certified products:

[http://www.energy.ca.gov/title24/equipment\\_cert/](http://www.energy.ca.gov/title24/equipment_cert/)

In residential buildings, the following must be certified by the manufacturer:

- Airflow measurement apparatus - forced air systems
- Airflow measurement apparatus - ventilation systems
- Air-to-water heat pump systems
- Intermittent mechanical ventilation systems
- Low leakage air-handling unit
- Occupant-controlled smart thermostats
- Demand responsive control systems

### 2.1.2 Compliance Document Registration

§10-103; Reference Residential Appendix RA2; Reference Joint Appendix JA7
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Registration of compliance documentation is needed for any construction for which HERS verification is required for compliance. Registration requirements are described in this chapter and throughout this manual. Also, *Reference Residential Appendix RA2 and Reference Joint Appendix JA7* provide detailed descriptions of procedures and responsibilities for registration of CF1R, CF2R, and CF3R.

Registration is needed for all low-rise residential buildings for which compliance requires HERS field verification. For all newly constructed homes, registration is required. There are some exceptions for additions and alterations. When registration is required, compliance documents are electronically submitted to an approved HERS provider data registry (HERS registry) for registration and retention.

Compliance documents submitted to the registry shall be certified by the applicable responsible person (§10-103). The registry will assign a unique registration number to the document(s) when completed and certification (by an electronic signature) is provided by the responsible person. The registry will retain the unique registered document(s) which are available via secure Internet access to authorized users. This allows users to make paper copies of the registered document(s) for purposes such as submittal to the enforcement agency, posting copies in the field for inspections, and providing copies to the building owner. (See Section 2.2.9.)

Authorized users of the registry include energy consultants, builders, building owners, construction contractors and installers, HERS Raters, enforcement agencies, and the Energy Commission. Authorized users are granted read/write access rights to the electronic data associated with their project(s) or responsibilities.

Documents submitted to public agencies for code compliance are public information.

## 2.2 Compliance Phases

### 2.2.1 Compliance and Enforcement

Complying with and enforcing the Energy Standards in residential buildings involve many parties. Those involved may include the architect or designer, builder/developer, purchasing agent, general contractor, subcontractor/installer, energy consultant, plan checker, inspector, Realtor, and owner/first occupant. All these parties must communicate and cooperate for the compliance and enforcement process to run efficiently.

The Energy Standards specify detailed reporting requirements intended to provide design, construction, and enforcement parties with the information to ensure that the energy features are properly installed. Each party is accountable to ensure that the features that they are responsible for are correctly installed. This section outlines each phase of the process and the responsibilities and requirements.

The energy compliance documentation has been revised and reorganized. Prescriptive versions of the certificate of compliance (CF1R) have been designed to be used specifically with:

1. Residential Newly Constructed Buildings (CF1R-NCB-01)
2. Residential Additions (CF1R-ADD-01)
3. Residential Alterations (CF1R-ALT-01)
4. Residential HVAC Changeouts (CF1R-ALT-02)
5. Solar Water Heating Worksheet (CF1R-STH-01)

The certificate of installation (CF2R) is separated into:

1. Envelope (CF2R-ENV)
2. Lighting (CF2R-LTG).
3. Mechanical (CF2R-MCH)
4. Plumbing (CF2R-PLB)
5. Solar Photovoltaic and Battery Storage, Solar-Ready Zone Area, and Solar Thermal Water Heating (CF2R- PVB, SRA, and STH, respectively)

These categories and most compliance measures have a separate CF2R form that is specific to a particular installation. CF2R forms also incorporate references to applicable mandatory measures. The HERS certificate of verification (CF3R) forms are categorized and organized in the same way as the CF2R forms. Refer to Appendix A of this manual for more information about the forms and to view samples of the forms. Additional information about the compliance documents will be provided throughout this manual.

When HERS verification is required for compliance, the Energy Standards require all residential energy compliance documents to be registered with a HERS provider

data registry. This accomplishes retention of a completed and signed copy of the submitted energy compliance documentation. To simplify the permit process for HVAC changeouts, §10-103 of the Energy Standards allows the registered CF1R-ALT-02 document to be submitted to an enforcement agency at final inspection and not before obtaining a permit. More details are in Chapter 9 of this manual. Document retention is vital to compliance and enforcement follow-up and other quality assurance follow-up processes that ensure energy savings from installed energy features. Reference Residential Appendix RA2 and Reference Joint Appendix JA7 has more details about document registration procedures building energy code compliance and enforcement process.

### 2.2.2 Design Phase

#### §10-103(a)2

This phase sets the stage for the type and style of building to be constructed. In addition to issues concerning zoning, lot orientation, and infrastructure, the overall design and energy features of the building are documented in the construction documents and/or specifications. Parties must ensure that the building complies with the Energy Standards and that the significant features required for compliance are documented on the plans and/or specifications.

During the design process, an energy consultant or other professional will assist the building designer by providing energy compliance documentations that determine the effect of building features being proposed for the design. This helps ensure that the final building design plans and specifications submitted to the enforcement agency will comply with the Energy Standards. Throughout this phase, energy consultants or the documentation author may suggest recommendations or alternatives to help the designer achieve compliance.

The building design plans submitted to the enforcement agency must include the specifications for the building energy features needed to achieve compliance, including insulation levels, window performance, equipment performance, lighting fixture types and controls, exhaust fan performance, envelope sealing, weather-stripping requirements, and any other feature that was used for compliance or is mandatory. The building design plans and specifications must be consistent with respect to the energy efficiency features information on the CF1R submitted to the enforcement agency. Any change in the building plans or specifications, during any phase of design or construction, that changes the energy feature specifications for the design requires recalculation of the building energy compliance. A revised CF1R that is consistent with the updated plans and specifications for the proposed building needs to be issued. If recalculation indicates that the building no longer complies, alternate building features must be selected so that it complies with the Energy Standards.

### 2.2.3 Permit Application

§10-103(a)2  
§10-103(a)1C

When the design is complete, the construction documents are prepared, and other approvals (planning department, water, and so forth) are secured, the owner or contractor applies for a building permit. This is the last step in the planning and design process. At this point, the infrastructure (streets, sewers, water lines, electricity, gas, and so forth) is in place or is being constructed, and construction on the building(s) begins.

To help the enforcement agency verify that the proposed building complies with the Energy Standards, compliance documents are submitted with the building permit application. These documents consist of a CF1R, which is required by the Energy Standards (see §10-103). The length and complexity of the documentation varies depending on factors such as the number of buildings that are being permitted, whether an orientation-independent permit is being requested, and whether the performance approach or the prescriptive approach is being used. An energy consultant who understands the code and is able to help the builder or owner comply with the standards often prepares the certificate of compliance documentation.

The administrative regulations §10-103(a)2 require that documentation be submitted with permit applications that will enable the plans examiner to verify compliance. The forms used to demonstrate compliance must be readily legible and shall conform to a format and informational order and content approved by the Energy Commission. If registration is required, the CF1R that is submitted to the enforcement agency must be a registered copy from an approved HERS Provider data registry.

### 2.2.4 Plan Check

The registration process requires the builder or designer to submit the certificate of compliance information and an electronic signature to an approved HERS registry to produce a completed, signed, and dated electronic CF1R that is retained by the registry. The CF1R is assigned a unique registration number. Copies of the registered CF1R are available to authorized users of the HERS Provider data registry for use in making electronic or paper copies of the registered document(s) for submitting to the enforcement agency as required.

Local enforcement agencies check plans to ensure that the building design conforms to the Energy Standards. This check includes health and safety requirements, such as fire and structural, and the building energy efficiency requirements. Vague, missing, or incorrect information items on the construction documents are identified by the plans examiner, and the permit applicant is required to make corrections or clarifications and then resubmit revised plans and specifications. Submitting

complete and accurate plans and specifications provides the plans examiner with the information needed to complete the plan check review quickly.

The plan checker verifies that the information on the construction documents is consistent with the requirements specified on the compliance documents. Examples of how the plans examiner will verify that the features detailed on the certificate of compliance forms are specified in the respective sections of the building plans include:

1. Verifying the window and skylight U-Factor and Solar Heat Gain Coefficient (SHGC) values from the CF1R on the structural/architecture plans in a window/skylight schedule, window/skylight legend for the floor plan.
2. Verifying the HVAC equipment and distribution information from the CF1R is clearly documented on the plans, such as SEER, EER, AFUE, HERS measures, and other values necessary to verify compliance.

The enforcement agency should clearly articulate to the builder/designer the acceptable methods of specifying energy features on the building plans for approval.

Since those buying building materials and the construction staff may rely solely on a copy of the approved plans and specifications, it is important that the building design represented on the approved plans and specifications complies with the Energy Standards as specified on the CF1R.

The enforcement agency's plans examiner must also verify that the compliance documents do not contain errors. When the compliance documents are produced by Energy Commission-approved computer software applications, there is less chance that there will be computational errors. The plans examiner must still verify that the design on the plans is consistent with the energy features on the certificate of compliance documents. A list of Energy Commission-approved energy code compliance software applications is at:

<http://www.energy.ca.gov/title24/2019standards/index.html>

Or call the Efficiency Standards Hotline at 1-800-772-3300.

With production homes, where a builder may be constructing several identical houses at roughly the same time, the compliance documentation may be prepared in such a way that a house or model can be constructed in any orientation. The plans examiner shall verify that the home complies facing all four main compass points (north, south, east, and west) on the CF1R form.

### **2.2.5 Building Permit**

After the plans examiner has approved the plans and specifications for the project, the enforcement agency may issue the building permit at the builder's request. Issuing the building permit is the first significant milestone in the compliance and enforcement processes. The building permit is the green light for the contractor to



begin the work. In some cases, the building permits are issued in phases. Sometimes there is a permit for site work and grading before the permit for actual building construction.

### **2.2.6 Construction Phase**

Upon receiving a building permit from the local enforcement agency, the contractor begins construction. The permit requires the contractor to follow the plans and specifications, but often there are variations. Some variations are formalized through change orders. When orders are issued, the permit applicant and the local jurisdiction are responsible to verify that the changes do not compromise compliance with the code. It is clear in some cases such as when a single-glazed, metal frame window is substituted for a high-performance double-pane, vinyl frame window. It may be difficult to determine compliance with changes such as orientation of the house or the location of a window. Field changes that result in noncompliance require enforcement agency approval of revised plans and revised energy compliance documentation to confirm that the building still complies with the Energy Standards.

During construction, the general contractor or specialty subcontractors are required to complete various CF2R. These certificates verify that the contractor is aware of the Energy Standards requirements and that they have followed the Energy Commission-approved procedures for installation, and to identify the energy efficiencies and features of the installed building components. The CF2R's are a collection of energy compliance information forms that apply to each regulated energy feature that may be included in the construction. The certificates are required to be completed by each of the applicable specialty contractors when they install regulated energy features such as windows, water heater and plumbing, HVAC ducts and equipment, lighting, and insulation.

The licensed person responsible for the building construction or for installation of an energy-related feature must ensure their work is done in accordance with the approved plans and specifications for the building. The person must complete and sign a certificate of installation to certify that the installed features, materials, components or manufactured devices for which they are responsible conform to the plans and specifications and the certificate of compliance documents approved by the enforcement agency for the building. A copy of the completed, signed, and dated CF2R must be posted at the building site for review by the enforcement agency in conjunction with requests for final inspection for the building. Copies of the registered CF2R forms shall be provided to the homeowner.

When any HERS verification is required for compliance, all CF2R forms must be registered from an approved HERS Provider data registry. When registration is required, the builder or installing contractor must submit information to an approved

registry to produce a completed, signed and dated electronic CF2R that is retained by the registry for use by authorized users of the registry. After the information to complete the CF2R document is transmitted to the data registry and the form is electronically signed, the CF2R is assigned a registration number. Copies of the unique registered CF2R are made available to authorized users of the registry to make electronic or paper copies of the registered document(s) for submittal to the enforcement agency as required. The builder or installing contractor must provide a copy of the completed, signed, and registered certificate of installation to the HERS Rater and post a copy at the building site for review by the enforcement agency in conjunction with requests for final inspection and provide copies of the registered CF2R forms to the homeowner.

More information about registering CF2R documents can be found in Reference Residential Appendix RA2 and Reference Joint Appendix JA7.

### **2.2.7 Enforcement Agency Field Inspection**

#### **§10-103(d)**

Local enforcement agency representatives inspect new buildings to ensure compliance with the Energy Standards. Field construction changes and noncomplying energy features require parties associated with previous phases to repeat and revise their original energy compliance documents or reinstall building components that meet the building specifications and energy compliance documents.

Enforcement agencies make multiple visits to a building site to verify construction. The first visit is typically made before the slab or the building foundation is poured. The building inspector verifies that the proper reinforcing steel is in place and that necessary wiring and plumbing that will be embedded in the slab meet the requirements of the standards. The inspector should verify features that are to be installed in or under concrete slab floors, such as slab edge insulation or hot water recirculation loops that involve piping that must be installed in the slab. The inspector should also verify the front orientation and floor assembly types (such as slab on grade, raised floor, and others) of the building during this phase of construction. Details of how the inspector should verify these components is in Chapter 3 of this manual.

The second visit occurs after the walls have been framed, and the HVAC equipment and ducting, fenestration, lighting cans, electrical wiring, plumbing, and other services have been constructed or installed. This inspection should be done before insulation is installed to ensure sealing and caulking around windows is completed, and the caulking and sealing of any holes bored through the framing members for installation of hot and cold water piping and electrical wiring. During the rough frame inspection, the inspector should also verify the installation of the high-efficacy

lighting so that the contractor can make any necessary corrections before the final inspection. This avoids having to remove drywall, insulation, and so forth to remove an incandescent can. The inspector should also verify the window/skylight U-factor and SHGC values, the proper sealing/installation of HVAC ducts and duct insulation R-value, the installation of exhaust fan housing and ducting in bathrooms and kitchens (ASHRAE 62.2.), and the installation of a radiant barrier and/or cool roof when required. Details of how the inspector should verify these components will be discussed in further in the respective chapters of this manual.

The third visit is the insulation inspection, which takes place after the wall, ceiling, and floor insulation have been installed. This inspection occurs before the drywall is installed to verify that the insulation R-value matches the CF1R form, and that the insulation has been properly installed without compressions, voids, or gaps. The inspector should verify that insulation is installed correctly around and behind piping, and that all exterior walls are insulated (especially behind obstructing objects like a bathtub). Details of how the inspector should verify these components is in Chapter 3.

The next visit is a drywall inspection, where the inspector verifies that the drywall is installed properly to limit infiltration and exfiltration, especially at locations surrounding lighting cans, HVAC registers and vents, and electrical sockets.

The final inspection is conducted after the walls have been closed and the final electrical and plumbing fixtures are in place. The inspector should verify HVAC efficiency values, water heating efficiency values, exhaust fan and other ventilation system noise level ratings in bathrooms and kitchens (ASHRAE 62.2), filter MERV rating and thickness, exterior lighting and controls, and weather stripping on exterior/demising doors. The inspector will also verify that all required CF2R and CF3R forms have been completed, signed, and registered. Copies of these forms should be provided to the building owner. Details of how the inspector should verify these components will be discussed further in this manual.

The typical enforcement agency inspection sequence can vary from jurisdiction to jurisdiction. It can be difficult for the enforcement agency to verify every energy efficiency measure required to be installed in the building. For example, exterior wall insulation will likely not be installed at the time of the framing inspection. If the enforcement agency does not include the insulation inspection in its field inspection process, the exterior wall insulation would be concealed from an inspector's view at the time of the final inspection.

The certificate(s) of installation and, when required, the certificate(s) of verification are crucial. When inspection of an installed energy feature would be impossible because of subsequent construction, the enforcement agency may require the CF2R for the concealed feature to be posted at the site or made available to the inspector upon completion/installation of the feature. To simplify the inspection, the inspector

would reference the efficiency values and building components specified on the submitted CF2R form to verify compliance with the Energy Standards.

When registration is required, all certificate(s) of installation must be registered through an approved HERS Provider data registry. For all measures requiring field verification, a registered certificate of verification shall also be made available to the building inspector.

### **2.2.8 Field Verification and/or Diagnostic Testing**

Some building features require field verification and/or diagnostic testing completed by a third party-inspector, called a HERS Rater, as a condition for compliance with the standards. The Energy Commission has established the California Home Energy Rating System (HERS) program to train and certify HERS Raters who are considered special inspectors by enforcement agencies. When compliance with the Energy Standards is based on energy features that require third-party (HERS) verification, a certified HERS Rater is required to perform field verification and/or diagnostic testing according to procedures in Reference Residential Appendix RA2 using the protocols in Reference Residential Appendix RA3.

There are mandatory measures, prescriptive measures, and performance credits that require HERS field verification and/or diagnostic testing. Most measures that require verification and testing involve air-conditioning equipment and forced air ducts that deliver conditioned air to the dwelling. Examples of measures requiring HERS verification are refrigerant charge measurement and duct sealing.

The Energy Standards mandate that all newly constructed homes with central HVAC systems have duct sealing (leakage testing), duct system airflow and fan watt draw (and installed HSP/PSPP), and exhaust fans/systems (ASHRAE 62.2.) verified by a HERS Rater when those systems are installed. Details about these measures are in Chapter 4 of this manual.

Additional measures requiring field verification include reduced duct surface area, increased duct R-value, high SEER and EER cooling equipment, and quality installation of insulation. A full list of measures requiring field verification and/or diagnostic testing is in Table RA2-1 of the *2019 Reference Residential Appendices*. The requirements for field verification and/or diagnostic testing apply only when equipment or systems are installed. If a house has no air distribution ducts, then a HERS Rater does not have to test them.

The rater must verify the required features and transmit all required data describing the feature and the results of the verification or diagnostic test to an approved HERS Provider data registry. The rater must also confirm that the installed energy feature being verified is consistent with the requirements for that feature as specified on registered copies of the CF1R approved by the enforcement agency for the dwelling. The person also must confirm the information on the CF2R is consistent with the

CF1R. The test results reported on the CF2R by the person responsible for the installation must be consistent with the test results determined by the rater's diagnostic verification and meet the criteria for compliance with the standards. A copy of the registered CF2R must be posted at the building site for review by the enforcement agency and made available for applicable inspections. A copy of the registered CF2R must also be left in the dwelling for the homeowner at occupancy.

Results from the rater's field verification or diagnostic test are reported to the HERS registry with "pass" or "fail". If the results are "pass", the registry will make a registered copy of the certificate of verification (CF3R) available. A copy of the registered CF3R must be posted at the building site for review by the enforcement agency and made available for all applicable inspections. Copies must be given to the builder and left in the dwelling for the homeowner at occupancy. If results are "fail," that failure must be entered into registry. HERS Providers shall not permit any user of the registry to print or access forms for noncompliance entries unless the CF3R form contains a watermark with the word "FAIL" or "FAILURE." Corrective action shall be taken by the builder or installer on the failed measure. The rater will retest the measure to verify that the corrective action was successful. Once the correction is made, the passing measure shall be entered into the registry.

### **2.2.9 Approval for Occupancy**

In multifamily dwellings of three or more units, the final step is the enforcement agency to issue an occupancy permit so occupants can move in. Single-family homes and duplexes may be approved for occupancy without an occupancy permit being issued. Often a signed-off final inspection serves as an approval for occupancy. When HERS verification is required before occupancy approval, the rater must post a signed and registered CF3R in the field for the building inspector to verify at final inspection. The rater must also provide copies of the registered CF3R to the builder and for the building owner at occupancy. Only registered CF3R documents are allowed for these submittals. Handwritten versions of the CF3R are not allowed.

### **2.2.10 Occupancy**

At the occupancy phase, the enforcement agency shall require the builder to leave all compliance documentation in the building, which includes at a minimum the CF1R and all applicable CF2R forms. When HERS field verification is required, a copy of the registered CF3R must be left on site with the compliance documentation. When registration is required, the CF1R and all required CF2R compliance documentation shall be registered copies. The builder is required to provide the homeowner with a manual that contains instructions for operating and maintaining the features of his or her building efficiently. More details are in Section 2.3.5.

## 2.3 Compliance Documentation

Compliance documentation includes the forms, reports, and other information that are submitted to the enforcement agency with an application for a building permit. It also includes documentation completed by the contractor or subcontractors to verify that certain systems and equipment have been installed correctly. It may include reports and test results by third-party inspectors (HERS Raters). The compliance documentation is included with a homeowner's manual so that the end user knows what energy features are installed in the house.

Compliance documentation is completed at the building permit phase, the construction phase, the field verification and diagnostic testing phase, and at the final phase. The required forms and documents are in Table 2-1 and described later. When registration is required, all the compliance documentation shall be registered copies from an approved HERS Provider data registry.

**Table 2-1: Documentation Requirements, Prescriptive and Performance Compliance Methods**

*A complete list and samples of energy compliance forms is in Appendix A.*

Phase	Method	Documentation Required When Applicable
Building Permit	Performance	CF1R-PRF-E, Certificate of Compliance
Building Permit	Prescriptive	CF1R-NCB-01-E, Certificate of Compliance
Building Permit	Prescriptive	CF1R-ADD-01-E, Certificate of Compliance (Additions less than 1,000 ft <sup>2</sup> )
Building Permit	Prescriptive	CF1R-ALT-01-E, Certificate of Compliance (Residential Alterations)
Building Permit	Prescriptive	CF1R-ALT-02-E, Certificate of Compliance (Alterations to HVAC systems)
Building Permit	Prescriptive	CF1R-ENV-02-E, Worksheet for area weighted average
Building Permit	Prescriptive	CF1R-ENV-03-E, Worksheet for solar heat gain coefficient (SHGC)
Building Permit	Prescriptive	CF1R-ENV-04-E, Worksheet for cool roofs and SRI
Building Permit	Prescriptive	CF1R-PLB-01-E, Worksheet for hydronic heating systems
Building Permit	Prescriptive and Performance	CF1R-STH-01-E, Worksheet for OG 100 solar water heating systems
Construction	Prescriptive and Performance	CF2R-E, Certificate of Installation

Phase	Method	Documentation Required When Applicable
Construction	Prescriptive and Performance	CF2R-H, HERS Certificate of Installation
Field Verification and/or Diagnostic Testing	Prescriptive and Performance	CF3R-H, Certificate of Verification (HERS Rater)
Field Verification and/or Diagnostic Testing	Performance	CF3R-EXC-20-H, Certificate of Verification for Existing Conditions (HERS Rater)  Note: This document must be completed before registering the CF1R-PRF-01-E when using the performance approach for an E+A+A and verification of existing conditions.

### 2.3.1 Building Permit Phase Documentation

#### §10-103(a)

The compliance documentation required at the building permit phase consists of the certificate of compliance (CF1R) on the building plans. Depending on the compliance approach, the energy compliance documentation package may also include the area weighted average calculation worksheet (CF1R-ENV-02-E), the solar heat gain coefficient (SHGC) worksheet (CF1R-ENV-03-E), and the cool roof and SRI worksheet (CF1R-ENV-04-E). Blank copies of these documents are in Appendix A of this manual to use the prescriptive compliance requirements. When the performance approach is used, only the CF1R-STH worksheets are needed since the Energy Commission-approved software performs the calculations and provides the necessary documentation contained in all other worksheets. When the performance approach is used, only the CF1R forms are required on the building plans.

The compliance documentation enables the plans examiner to verify that the building design shown in the plans and specifications complies with the Energy Standards. It enables the field inspector to identify which building features are required for compliance and will be verified in the field.

### 2.3.2 Certificate of Compliance (CF1R)

The Energy Standards require the certificate of compliance to be incorporated into the plans for the building and submitted to the enforcement agency. The CF1R form identifies the minimum energy performance specifications selected by the building designer or building owner for compliance and may include the results of the heating and cooling load calculations.

To meet the requirement for filing a copy of the CF1R with the building plans, builders/contractors should ask the local enforcement agency for information about

their preferences or requirements for document submittal procedures. Most local jurisdictions may require the CF1R to be embedded in the building design computer-aided drafting (CAD) file for plotting on sheets that are the same size as the plan set sheets of the building design. Thus, the CF1R documentation would be submitted as energy compliance design sheets integral to the entire plan set for the building. Some jurisdictions may allow taping CF1R document sheets to the submitted design drawings for the building. Others may allow attaching 8-½-inch x 11-inch printed CF1R document reports to the submitted design drawing package.

When the prescriptive approach is used for additions and alterations, a shorthand version of the certificate of compliance shall be submitted with the building plans or with the permit application when no plans are required. In these instances, 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 changeouts. More details are in Chapter 9.

For low-rise residential buildings for which compliance requires field verification, the CF1R submitted to the enforcement agency must be a registered copy from an approved HERS Provider data registry. More information is in the Reference Residential Appendix RA2 and Reference Joint Appendix JA7.

### 2.3.3 Construction Phase Documentation (CF2R)

#### §10-103(a)3

The certificate(s) of installation (CF2R) are separated into envelope (CF2R-ENV), lighting (CF2R-LTG), mechanical (CF2R-MCH), plumbing (CF2R-PLB), and solar (CF2R-PVB and CF2R-STH) categories. Most compliance measures have a separate CF2R form that is specific to a particular installation. The CF2R forms must be completed during the construction or installation phase. The documents must be completed by the applicable contractors responsible for installing regulated energy features such as windows (fenestration), the air distribution ducts and the HVAC equipment, the exhaust fans/ventilation system, the measures that affect building envelope tightness, the lighting system, and the insulation. The CF2R must be posted at the job site in a conspicuous location (for example, in the garage) or kept with the building permit and made available to the enforcement agency upon request.

When field verification and/or diagnostic testing of a feature is required for compliance (as shown in the HERS required certification section of the CF1R), the builder or the builder's subcontractor must perform the initial field verification or diagnostic testing of the installation to confirm and document the applicable CF2R compliance with the standards using the applicable procedures specified in Reference Residential Appendix RA3. The builder, the builder's subcontractor, or authorized representative must submit the CF2R information to an approved



registry. All CF2R information submittals must be done electronically when HERS verification/testing is required.

### **2.3.4 Field Verification and/or Diagnostic Testing Documentation (CF3R)**

#### **§10-103(a)5**

Within the Energy Standards, some mandatory measures, some prescriptive requirements, and some measures that may be used for compliance in the performance approach may require field verification and/or diagnostic testing. This testing must be performed by a third-party inspector who is specially trained and independent from the builder or general contractor. The Energy Commission recognizes HERS Raters for this purpose.

When field verification and/or diagnostic testing is required, the rater must complete, register, and sign/certify the certificate of verification (CF3R). The CF3R documents include information about the measurements, tests, and field verification results that were required to be performed. The rater must verify that the requirements for compliance have been met.

The HERS Rater chosen for the project must transmit the CF3R information to an approved HERS Provider data registry. This must be the same registry through which the previous compliance documents (CF1R, CF2R) for the project were registered. The rater used for the project must be certified by the HERS Provider into whose registry the project has been entered. A registered CF3R from the provider that has been signed or certified by the rater is made available to the enforcement agency and to the builder when HERS verification confirms compliance. The builder ensures that the enforcement agency has received the CF3R before the occupancy permit or final inspection.

Raters shall provide a separate registered CF3R form for each house that the rater determines has met the verification or diagnostic requirements for compliance. The rater shall not sign a CF3R for a house that does not have a registered CF2R that has been signed/certified by the installer. If the building was approved as part of a sample group, the CF3R will include additional information that identifies whether the building was a tested or a not tested building from the sample group. The CF3R form for the tested home of a sample group will include the test/verification results, but the not tested homes will not. CF3R forms for not tested homes in a sample group will still have a registration number, date, time, and a watermark of the HERS Provider's seal. Refer to Reference Residential Appendix RA2 for more details on HERS verification and CF3R documentation procedures.

### **2.3.5 Compliance, Operating, Maintenance, and Ventilation Information to Be Provided by Builder**

#### **§10-103(b)**

The final documentation in the process is the information that is provided to the homeowner. At the completion of construction and before occupancy, the enforcement agency shall require the builder to leave in the building the applicable completed, signed and dated compliance documentation including, at a minimum, the applicable CF1R forms, CF2R forms, and, if compliance required HERS verification, the applicable CF3R forms. When registration is required, these compliance documents shall be registered copies. In addition to the compliance documentation, the builder must leave in the building operating and maintenance information for all installed features, materials, components, and manufactured devices. The operating and maintenance information must contain the details needed to provide the building owner/occupant with instructions on how to operate the home in an energy-efficient manner that ensures satisfactory indoor air quality and to maintain it so that it will continue to work efficiently. For individually owned units in a multifamily building, the documentation must be provided to the owner of the dwelling unit or to the individual(s) responsible for operating the feature, equipment, or device. Information must be for the appropriate dwelling unit or building. Paper or electronic copies of these documents are acceptable.

#### Example 2-1

##### **Question**

What are the plan checking/field inspection requirements related to the CF-2R?

##### **Answer**

The CF2R (certificate of installation) is not submitted with compliance documentation at the time of permit application. It is posted or made available for field inspection after installation. A field inspector should check the equipment that is actually installed against what is listed on the CF2R and compare the CF2R and CF1R for consistent equipment characteristics. The field inspector should do this for all installed building components indicated on a CF2R form (HVAC, fenestration, insulation, water heating, and so forth).

When HERS verification is required for compliance, the field inspector should check the HERS-required verification listings on the CF1R to identify the required installer tests and verify that these tests were performed and documented on the applicable certificate(s) of installation (CF2R).

The enforcement agency may request additional information to verify that the installed efficiency measures are consistent with the approved plans and specifications. When material properties or equipment efficiencies greater than the minimum requirements are shown on the CF1R, the enforcement agency may have procedures for verifying the actual material or equipment specifications. For example, the enforcement agency may require the installer to provide a copy of the applicable page(s) from a directory of certified equipment.

#### Example 2-2

**Question**

What happens to the CF2R after the final inspection?

**Answer**

§10-103(b) requires the builder to leave a copy of the CF2R in the building for the building owner at occupancy.

## Example 2-3

**Question**

As a general contractor, when I have finished building a home, is there a list of materials I am supposed to give to the building owner?

**Answer**

Section 10-103(b) requires that at final inspection the enforcement agency shall require the builder to leave compliance, operating, maintenance, and ventilation information in the building for the “building owner at occupancy,” which includes the:

1. Certificate of compliance (CF1R).
2. Certificate(s) of installation (CF2R).
3. Certificate(s) of verification (CF3R) if applicable.
4. Operating information for all applicable features, materials, components, and mechanical devices installed in the building.
5. Maintenance information for all applicable features, materials, components, and manufactured devices that require routine maintenance for efficient operation.

## Example 2-4

**Question**

I built some multifamily buildings and have some questions about the information I must provide to the building owner at occupancy (as required by §10-103(b)). Specifically:

If the building is a condominium, can I photocopy the same CF1R information for all units?

When the building is an apartment complex (not individually owned units), who gets the documentation?

If an apartment is converted to condominiums, does each owner/occupant receive copies of the documentation?

**Answer**

Photocopied information is acceptable. It must be obvious that the CF1R documentation applies to that dwelling unit. The features installed must match the features shown on the certificate(s) of installation (CF2R). If the compliance documentation is for a whole building, a photocopy of the CF1R for that building must be provided. If individual compliance is shown for each unique dwelling unit, a photocopy of the documentation that applies to that dwelling unit must be provided. The copies may be in paper or electronic format.

The documentation and operating information are provided to the individual responsible for operating the feature, equipment, or device (typically the occupant). Maintenance information is provided to the person responsible for maintaining the feature, equipment or device. This is either the owner or a building manager (§10-103(b)).

If, during construction, the building changes from an apartment to condominiums, each owner at occupancy would receive the documentation. If an existing apartment building changes to condominiums at a later date, the documentation requirements are triggered only by a building permit application requiring compliance with the Energy Standards. Changing occupancy does not trigger compliance with the standards.

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## 2.4 Roles and Responsibilities

### 2.4.1 Designer

*5537 and 6737.1 of California Business and Professions Code*

The designer is responsible for the overall building design. The designer specifies the building features that determine compliance with the Energy Standards and other applicable building codes. The designer is required to sign the certificate of compliance (CF1R) to certify that the building complies with the Energy Standards.

The designer may personally prepare the documents or may delegate preparation of the energy analysis and certificate of compliance documents to an energy documentation author or energy consultant. If preparation of the compliance documentation is delegated, the designer must remain in charge of the building design specifications, energy calculations, and all building feature information represented on the certificate of compliance. The designer's signature on the certificate of compliance affirms his or her responsibility for the information submitted.

The designer may be an architect, engineer or other California-licensed professional; however, a licensed design professional may not always be required for low-rise residential buildings. *The California Business and Professions Code* allows unlicensed designers to prepare design documentation for wood-framed single-family residential building if the dwellings are no more than two stories high, not counting a possible basement. Two-story, wood-framed multifamily buildings may also be designed by unlicensed designers if the building has four or fewer dwelling

units. For homes that do not require a licensed design professional, the builder may sign the CF1R in the “Responsible Building Designer’s” signature block.

When the designer is a licensed professional, the signature block on the certificate must include the designer's license number. When registration is required, the certificate of compliance must be submitted to an approved HERS Provider data registry. All submittals to the registry must be made electronically.

## 2.4.2 Documentation Author

§10-103(a)1

The person who designs the building may delegate the energy analysis and preparation of the certificate documentation to a building energy consultant or documentation author. A completed Certificate of Compliance must be submitted to the enforcement agency during the building permit phase. The certificate demonstrates to the enforcement agency plan checker that the building design complies with the Energy Standards. The information submitted on the certificate must be consistent with the building design features in the plans and specifications for the building submitted to the enforcement agency.

The documentation author is not subject to the same limitations and restrictions of the *Business and Professions Code* as is the building designer because the documentation author is not responsible for specification of the building design features. The documentation author may provide the building designer with recommendations for building energy features. If building designer approves the recommendations, the features must be incorporated into the design plans and specification documents submitted to the enforcement agency at plan check. The documentation author’s signature on the certificate of compliance certifies that the documentation is accurate and complete but does not indicate documentation author responsibility for the specification of the features that define the building design. The documentation author provides completed certificate of compliance documents to the building designer, who must sign the certificate before submitting it to the enforcement agency at plan check.

If registration of the certificate of compliance is required, it must be submitted to the registry and signed electronically by both the designer and documentation author before submitting to the enforcement agency. When document registration is required, only registered certificates of compliance that display the registration number assigned to the certificate by an approved HERS registry are acceptable for submittal to the enforcement agency at plan check.

A list of recommended documentation authors is at the California Association of Building Energy Consultants’ (CABEC) website at <http://www.cabec.org>

### 2.4.3 Builder or General Contractor

Chapter 9 of the *Business and Professions Code* specifies the term “contractor” is synonymous with the term “builder.” This manual uses “builder” to refer to the general contractor responsible for construction. For production homes, the builder may also be the developer responsible for arranging financing, acquiring the land, subdividing the property, securing the necessary land planning approvals, and attending to the other necessary tasks that are required before actual construction. Many production builders are involved in marketing and sales of homes after they are constructed.

During the construction process, the builder or general contractor usually hires specialty subcontractors to provide specific services, such as installing insulation, designing and installing HVAC systems, installing windows and skylights, installing water heating systems, and other services. For homes that do not require a licensed design professional, the builder may sign the CF1R in the “Responsible Building Designer's” signature block.

The builder or general contractor must ensure that certificate(s) of installation (CF2R) are submitted to the enforcement agency by the person(s) responsible for the construction/installation of regulated features, materials, components, or manufactured devices. The builder or general contractor may sign the certificate of installation on behalf of the specialty subcontractors they hire, but the preparation and signature responsibility reside with the specialty subcontractor who provided the installation services. The certificate of installation identifies the installed features, materials, components, or manufactured devices detailed in the plans and specifications, and the certificate(s) of compliance approved by the local enforcement agency. If the installation requires field verification and diagnostic testing by a HERS Rater, the certificate of installation must report the results of the installer's testing of the regulated installations to measure performance. The certificate and the CF2R shall be submitted to an approved HERS registry. A copy of the registered certificate of installation is required to be posted at the building site for review by the enforcement agency in conjunction with requests for final inspection.

When the Energy Standards require registration of the compliance documents, the builder or general contractor must ensure the transmittal/submittal of the required information to an approved HERS registry. The builder or general contractor must arrange for the services of a certified HERS Rater if the certificate of compliance indicates that third-party field verification and diagnostic testing by a rater is required. The builder or general contractor must ensure that a copy of the certificate that was approved by the designer/owner and submitted to the enforcement agency during the permitting phase is transmitted to the registry. The certificate should be made available to the rater who will perform any required field verification and diagnostic testing.

When installation work is complete, the builder or general contractor must ensure that the persons responsible for the installation have transmitted/submitted the required certificate of installation information to the registry. The builder must ensure that the HERS Rater receives a copy of the completed certificate of installation or provide access to the registry that has been registered and signed by the builder or subcontractors responsible for the installation. When registration of the certificate of installation is required, the completed and signed copies that are posted at the building site for review by the enforcement agency, in conjunction with requests for final inspection, are required to be registered copies.

At final inspection, the builder or general contractor is required to leave in the building all applicable completed, signed, dated, and registered (when applicable) compliance documents for the building owner at occupancy. Such information must, at a minimum, include information indicated on the following forms: certificate of compliance (CF1R); certificate(s) of installation (CF2R); and for buildings for which compliance requires HERS field verification, certificate(s) of verification (CF3R). These forms must be in paper or electronic format and must conform to the applicable requirements of §10-103(a).

#### **2.4.4 Specialty Subcontractors**

Specialty subcontractors provide the builder with services from specific building construction trades for installation of features such as wall and ceiling insulation, windows, HVAC systems and/or duct systems, water heating systems, and plumbing systems, and these subcontractors may perform other trade-specific specialty services during building construction. The builder is responsible for all aspects of building construction and has the authority to complete and sign/certify all sections of the required certificate(s) of installation (CF2R) forms. The licensed specialty subcontractor, however, should be expected to complete and sign/certify all applicable certificate(s) of installation that document the completion of the work they have performed. The subcontractor's responsibility for documentation should include providing a registered (when applicable) and signed copy of all applicable CF2R's to the builder and posting a registered (when applicable) and signed copy of all applicable CF2Rs at the building site for review by the enforcement agency. The subcontractors should make the registered and signed copies of the applicable installation forms available to the HERS Rater if third-party field verification is required for compliance, as specified on the CF1R.

When the Energy Standards require document registration, all copies of the certificate(s) of installation submitted to the builder, the enforcement agency, and the HERS Rater are required to be registered copies prepared by following the procedures in Reference Residential Appendix RA2, Reference Joint Appendix JA7, and Section 2.3 of this manual.

## 2.4.5 Enforcement Agency

### §10-103

The enforcement agency is the local agency with responsibility and authority to issue building permits and verify compliance with applicable codes and standards. The agency performs several key roles in the compliance and enforcement process.

#### 2.4.5.1 Plan Check

The enforcement agency performs plan check review of the certificate(s) of compliance documentation and of the plans and specifications that define the building design submitted to the enforcement agency at the building permit phase. During plan check, the agency compares certificate of compliance documentation to the plans and specifications for the building design to confirm that the building features are specified consistently in all the submitted documents. If the specification for design features on the certificate of compliance does not conform to the specifications on the designer's submitted plans and specifications for the building, the designer must revise the submitted documents to make the design specification consistent in all documents.

If the certificate of compliance indicates the building complies, and they are consistent with the features on the plans and specifications for the building design, then the plan check process can confirm that the design complies with the building energy code. If the enforcement agency determines that the building design complies with the Energy Standards, in addition to all the other building codes, it may issue a building permit. When the Energy Standards require document registration, the certificate of compliance documentation submitted for a plan check must be a registered document from an approved registry. The one exception is the CF1R-ALT-02-E for HVAC changeouts. If approved by the enforcement agency, permit applicants may use unregistered CF1R-ALT-03-E or CF1R-ALT-04-E documents (dependent upon climate zone) to apply for permits and present the registered CF1R-ALT-02-E to the inspector at the time of the final permit.

#### 2.4.5.2 Construction Inspection

During building construction, the enforcement agency should make several visits to the construction site to verify that the building is being constructed in accordance with the approved plans and specifications and energy compliance documentation. At each site visit, the agency should review any applicable certificate(s) of installation that have been posted or made available with the building permit(s). The enforcement agency should confirm that the energy efficiency features installed in the house are consistent with the requirements given in the plans and specifications for the building approved during plan check, that the installed features are described accurately on the certificate(s) of installation, and that all applicable sections of the



certificate(s) of installation have been signed by the responsible licensed person(s). The enforcement agency shall not approve a dwelling unit until it has received all applicable certificate(s). When the Energy Standards require registration of the energy compliance documents, the certificate(s) of installation documents must be registered with an approved registry.

#### **2.4.5.3 Corroboration of Field Verification and Diagnostic Testing Procedures**

As described in Reference Residential Appendix Section RA2.4.4, at its discretion, the enforcement agency may require that field verification and diagnostic testing performed by the builder or subcontractors or the certified HERS Rater must be scheduled to be performed at a time when the enforcement agency's field inspector can observe the verification or test procedures to corroborate the results reported/documented on the certificate(s) of installation (CF2R) and/or the certificate(s) of verification (CF3R).

#### **2.4.5.4 Sampling Within Enforcement Agency Jurisdictions**

When sampling is used for HERS verification compliance for newly constructed buildings, all dwellings in a designated sample group must be located within the same enforcement agency jurisdiction and subdivision or multifamily housing development, as specified in Reference Residential Appendix Section RA2.6.3.1

When sampling is used for HERS verification compliance for alterations, the dwellings in a designated sample group are not required to be located within the same enforcement agency jurisdiction. The building owner may choose for the field verification and diagnostic testing to be completed as part of a designated sample group composed of dwelling units for which the same installing company has completed the work that requires field verification and diagnostic testing for compliance, as specified in Reference Residential Appendix Section RA2.8. However, to enable the enforcement agency to schedule testing to accomplish the corroboration described in the previous section, it may choose to require that a separate dwelling unit from the sample group that is located within the respective jurisdiction be tested.

#### **2.4.5.5 Final Approval**

The enforcement agency may approve the dwelling at the final inspection phase if the agency field inspector determines that the dwelling conforms to the requirements of the plans and specifications of the building and certificate of compliance documents approved by the enforcement agency at plan check and meets all other applicable codes and standards requirements. For dwelling units that have used an energy efficiency compliance feature that requires certificate of installation documentation, the enforcement agency shall not approve the dwelling unit until the agency has received a certificate meeting the §10-103(a) requirements that has

been completed, signed, and registered (when applicable) by the builder or subcontractor.

For dwelling units requiring third-party HERS field verification and diagnostic testing for compliance, the enforcement agency shall not approve the dwelling unit until the agency has received a registered copy of the certificate of verification that meets the requirements of §10-103(a) and has been signed and dated by the HERS Rater. The builder must ensure that all such required energy compliance documentation has been completed properly and posted at the job site or submitted to the enforcement agency in conjunction with any of the agency's required inspections. However, the agency, in accordance with §10-103(d), as a prerequisite to approval of the building, must examine all required copies of certificate(s) of installation (CF2R) documentation and certificate(s) of verification (CF3R) documentation posted at the site or made available with the building permits for the required inspections. This confirms that they have been properly prepared and are consistent with the plans and specifications and the certificate of compliance documentation approved by the enforcement agency for the building at plan check.

When an alteration has been performed by a participating Third-Party Quality Control Program (TPQCP) contractor (see Section 2.4.8 of this manual), the enforcement agency may conditionally approve the building based on the certificate of installation (CF2R) if the TPQCP data checking has indicated that the installation complies. However, if subsequent HERS compliance verification procedures determine that resampling, full testing, or corrective action is necessary for such conditionally approved dwellings in the group, the corrective work must be completed. Additional information is in Reference Residential Appendix RA2.4.3, RA2.7, and RA2.8.

#### **2.4.5.6 Corroboration of Information Provided for the Owner/Occupant**

At final inspection, the enforcement agency shall require the builder to leave in the building (for the building owner at occupancy) energy compliance, operating, maintenance, and ventilation information documentation as specified by §10-103(b).

Compliance documents for the building shall, at a minimum, include information indicated on forms: certificate of compliance (CF1R), certificate(s) of installation (CF2R), and, for buildings for which compliance requires HERS field verification, certificate(s) of verification (CF3R). These forms shall be copies of the documentation submitted to or approved by the enforcement agency, and the copies must conform to the applicable requirements of §10-103(a).

Operating information shall include instructions on how to operate or maintain the buildings energy features, materials, components, and mechanical devices correctly and efficiently. Such information shall be in a folder or manual that provides all information in §10-103(b). This operating information shall be in paper or electronic

format. For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component, or mechanical device installed in the building. This information shall be in paper or electronic format.

Maintenance information shall be provided for all features, materials, components, and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component, or manufactured device. For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component, or mechanical device installed in the building. This information shall be in paper or electronic format.

Ventilation information shall include a description of the quantities of outdoor air that the ventilation system(s) are designed to provide to the conditioned space of the building, and instructions for proper operation and maintenance of the system. For buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component, or mechanical ventilation device installed in the building. This information shall be in paper or electronic format.

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#### Example 2-5

##### **Question**

We are an enforcement agency with jurisdiction over the replacement of the outdoor compressor/condenser unit of an HVAC unit (an alteration), and the HVAC contractor who pulled the permit for replacing the unit has requested that we approve the final inspection and close out the permit based only on the certificate of installation (CF2R) for this job. This job requires HERS verification, and I thought it was necessary to receive the HERS Rater's completed and signed certificate of verification (CF3R) before the job could comply as a condition to final approval of the installation. Is there an allowance for compliance based only on the CF2R?

##### **Answer**

Yes. The enforcement agency may provide a conditional final approval of the installation based upon the CF2R for alterations jobs only, and only if the installing contractor is an approved Third-Party Quality Control Program (TPQCP) installing contractor. The conditional final approval is allowed if TPQCP data checking has scrutinized the diagnostic test data submitted by the approved contractor's diagnostic test for the installation, and such data checking indicates the installation complies as shown on the CF2R.

The permittee is still required to complete all HERS verification procedures and comply with all HERS verification criteria. A CF3R is still required to be submitted to the enforcement agency, builder, and homeowner for the documentation procedure to be complete. If HERS verification of the approved TPQCP contractor's installation work determines that resampling, full testing, or corrective action is necessary to bring the installation into compliance, such work must be completed before issuing the CF3R. Sampling procedures for HERS verification for installation work performed by an approved TPQCP contractor allows for testing of one sample from a designated group of up to 30 dwellings/installations for which the work was performed by the same approved TPQCP installing contractor. Refer to Reference Residential Appendix Sections RA2.4.3, RA2.7 and RA2.8 (and Chapter 9 of this manual) for additional information.

#### 2.4.6 HERS Provider

<http://www.energy.ca.gov/HERS/>

A HERS Provider is an organization that the Energy Commission has approved to administer a HERS program. The provider certifies and trains raters and maintain quality control over the activities performed by HERS Raters who provide third-party field verification and diagnostic testing on installed energy efficiency features in dwellings when required for compliance with the Energy Standards. Visit the Energy Commission website for the list of approved HERS Providers.

The HERS Provider must maintain a database (data registry) that incorporates a website-based user interface that accommodates the needs of the authorized users of the data registry who administer HERS compliance, document registration, and Energy Standards enforcement. The data registry must receive and record information that can adequately identify and track measures that require HERS verification in a specific dwelling and must have the capability to determine compliance based on the information input from the results of applicable testing or verification procedures reported as input to the data registry for the dwelling. When the requirements for compliance are met, the registry must make available a unique registered certificate for use in complying with document submittal requirements to enforcement agencies, builders, building owners, HERS Raters, and other interested parties. The registry must simplify electronic submittal of the registered certificates to an Energy Commission document repository for retention of the certificates for use in regulations enforcement.

The HERS Provider must make available via phone or Internet communications interface a way for building officials, builders, raters, and other authorized users of the registry to verify the information displayed on copies of the submitted compliance documentation. Refer to Reference Residential Appendices Section RA2.4.2 and Reference Joint Appendix JA7 for additional information.

#### **2.4.7 HERS Rater**

The HERS Rater is trained and certified by an Energy Commission-approved HERS Provider to perform the field verification and diagnostic testing that may be required to demonstrate and document compliance with the Energy Standards. Raters receive special training in diagnostic techniques and building science as part of the certification administered by the HERS Providers. Therefore, HERS Raters are considered special inspectors by enforcement agencies and shall demonstrate competence, to the satisfaction of the agency, to conduct the required visual inspections and diagnostic testing of the regulated energy efficiency features installed in the dwelling.

HERS Raters should recognize that some enforcement agencies charge a fee for special inspectors in their jurisdictions. Because they are special inspectors for the enforcement agency, a rater may be disciplined (for example, prohibit a HERS Rater from conducting field verifications/testing in a local jurisdiction) if the agency determines that a rater does not comply with the Energy Standards. Raters may also be required to attain business licenses in some jurisdictions.

If the documentation author who produced the certificate of compliance documentation for the dwelling is not an employee of the builder or subcontractor, the documentation author for the dwelling may also perform the responsibilities of a HERS Rater, provided the documentation author has met the requirements and has been certified, and is associated with an Energy Commission-approved HERS Providers.

If requested to do so by the builder or subcontractor, the rater may help the builder or subcontractor transmit/submit the certificate(s) of installation (CF2R) information to the provider for registration. However, the HERS Rater may not certify the information on a certificate of installation. The builder or subcontractor responsible for the installation must provide the certification/signature to confirm the information submitted to the registry, even if the rater transmitted the data. Refer to Reference Residential Appendix Section RA2.5 and Reference Joint Appendix JA7 for more information.

The HERS Rater conducts the field verification and diagnostic testing of the installed special features when required by the certificate of compliance. The rater must transmit the results of the field verification and diagnostic testing to the HERS registry. The rater must provide to the registry all information required to complete

the certificate(s) of verification form and must submit a certification/signature to the registry. The data registry will make available registered copies of the certificate(s) of verification to the rater, the builder, the enforcement agency, and other authorized users of the registry. Printed copies, electronic or scanned copies, and photocopies of the completed, signed, and registered certificate(s) of verification (CF3R) are allowed for document submittals, subject to verification that the information contained on the copy conforms to the registered document information on file in the HERS registry for the dwelling. A completed, signed, and registered copy of the CF3R must be posted at the building site or made available to the inspector for review by the enforcement agency in conjunction with requests for final inspection for each dwelling unit.

Go to Reference Residential Appendix Section RA2.4.2 for more information.

#### Example 2-6

##### **Question**

Can a certified HERS Rater who does the field verification and completes and signs the CF3R for a dwelling also perform the testing required of the builder or installer to certify compliance with the Title 24, Part 6 installation requirements on the CF2R?

##### **Answer**

Yes. This approach is allowed when the HERS Rater is doing field verification for every dwelling (100 percent testing), but it is not allowed when the rater performs verification using a designated sample group of dwellings. When 100 percent testing is used for HERS verification, the builder or the installer may use the information from the rater's verification or diagnostic test results when completing the CF2R. When doing so, builders or installers signing the certification statement on the CF2R are assuming responsibility for the information in the form and are certifying that the installation conforms to all applicable codes and regulations. The rater may not sign the form and cannot be assigned the responsibilities of the builder or installer, as stated on the CF2R form and in regulations.

If the HERS Rater determines that the compliance requirements are not met, the HERS Rater will submit the data of the failed verification/testing into a HERS registry for retention. The builder or installer must make the needed corrections. Once corrections have been made and the rater determines that all compliance requirements are met, the builder or installer may certify the work by completing and signing the applicable section of the CF2R. The HERS Rater can complete the CF3R documentation for the dwelling.

#### Example 2-7

##### **Question**

I heard that there are conflict-of-interest requirements that HERS Raters must abide by when doing field verification and diagnostic testing. What are these requirements?

**Answer**

Raters are expected to be objective, independent third parties as field verifiers and diagnostic testers. They are special inspectors for local enforcement agencies. By law, raters must be independent entities from the builder or subcontractor installer of the energy efficiency features being tested and verified. They can have no financial interest in the installation of the improvements. Raters cannot be employees of the builder or subcontractor whose work they are verifying. Also, they cannot have a financial interest in the builder's or contractor's business, or advocate or recommend the use of any product or service that they are verifying.

The Energy Commission expects HERS Raters to enter into a contract with the builder (not with subcontractors) to provide independent, third-party diagnostic testing and field verification. The procedures adopted by the Energy Commission call for direct reporting of results to the builder, the HERS Provider, and the building official. Although not recommended by the Energy Commission, a three-party contract among builder, rater and subcontractor is possible, provided that the contract delineates the independent responsibilities of the rater and the responsibilities of a subcontractor to take corrective action in response to deficiencies found by a rater. Such contracts may also establish the role for a subcontractor to serve as administrator for the contract, including scheduling the rater, invoicing, and payment, provided the contract ensures that money paid by the builder to rater can be traced through audit. It is critical that such contractors preserve the rater's independence in carrying out the responsibilities specified in Energy Commission-adopted HERS field verification and diagnostic testing procedures. Even though such contracts do not violate the requirements of the Energy Commission, the closer that the working relationship is between the rater and the subcontractor whose work is being inspected, the greater the potential for compromising the rater's independence.

Compliance cannot be shown using sampling if a three-party contract is used. One hundred percent of homes must be tested by a HERS Rater when a three-party contract is used. Raters must use their own diagnostic equipment and not the installing contractor's equipment when verifying work performed when a three-party contract is used.

(See *Blueprint #66*, pp. 1-2, and *Blueprint #67*, p. 7.)

HERS Providers must provide ongoing monitoring of the propriety and accuracy of raters in the performance of their duties and to respond to complaints about the rater's performance. Where there may be real or perceived compromising of the rater's independence, the provider is responsible for increasing scrutiny of the rater and act to ensure objective, accurate reporting of diagnostic testing and field verification results, in compliance with Energy Commission-adopted procedures.

Enforcement agencies have authority to require raters to demonstrate their competence to the satisfaction of the building official. When the rater's independence is in question, building officials can prohibit a particular rater from being used in their jurisdiction or disallow practices that the building official believes will compromise the rater's independence. Building officials may require the use of a three-party contract. For additional information please contact the Energy Commission Hotline.

### **2.4.8 Third-Party Quality Control Program**

The Energy Commission may approve Third-party Quality Control Programs (TPQCP) that serve some of the functions of HERS Raters for field verification but do not have the authority to sign compliance documentation as a rater. The programs do the following:

- A. Train installers, participating program installing contractors, installing technicians, and specialty third-party quality control program subcontractors about compliance requirements for measures for which diagnostic testing and field verification is required.
- B. Collect data from participating installers for each installation completed for compliance credit.
- C. Perform data checking analysis of information from diagnostic testing performed on participating TPQCP contractor installation work to evaluate the validity and accuracy of the data and to independently determine whether compliance has been achieved.
- D. Provide direction to the installer to retest and correct problems when data checking determines that compliance has not been achieved.
- E. Require resubmission of data when retesting and correction is directed.
- F. Maintain a database of all data submitted by the participating TPQCP contractor in a format that is acceptable and made available to the Energy Commission upon request.

The HERS Provider must arrange for an independent rater to conduct independent field verifications of the installation work performed by the participating TPQCP contractor and third-party quality control program. If group sampling is used for HERS verification compliance for jobs completed by a participating TPQCP contractor, the sample from the group that is tested for compliance by the rater may be selected from a group composed of up to 30 dwellings for which the same participating contractor has performed the installation. For alterations, the installation work performed by TPQCP contractors may be approved at the enforcement agency's discretion, based upon a properly completed certificate of installation (CF2R) as described in Section 2.4.5, on the condition that if subsequent HERS compliance verification procedures determine that resampling, full testing, or corrective action is necessary for such conditionally approved dwellings in the group, the corrective work must be completed. If the standards require registration of the certificate of installation, the certificate must be a registered copy from a data registry.

Refer to Reference Residential Appendix RA2.4.3, RA2.7, and RA2.8 for additional information.



### 2.4.9 Owner

Building owner means the owner of the dwelling unit. For production homes, the owner is the person or family that the builder sells the house to. In custom homes and remodels, the owner may be the builder or developer, a general contractor, architect, or engineer.

As part of the compliance process, the owner must receive compliance, operating, maintenance, and ventilation information documents at the time of occupancy. The enforcement agency must require the builder to leave this information in the building for the building owner at occupancy as specified in §10-103(b).

#### Example 2-8

##### Question

What is my responsibility with respect to the CF2R (certificate of installation) as (a) an enforcement agency inspector and (b) as a builder?

##### Answer

(a) The enforcement agency's field inspector verifies that the required CF2R form(s) are filled out completely and in conformance with the requirements of §10-103(d) during applicable site inspections, which includes verifying the CF2R is registered when required by the standards and confirming that the person responsible for the installation has signed the certificate. Inspectors must verify that the installed features conform to the plans and specifications and the certificate of compliance approved by the enforcement agency.

The CF2R is required to be posted at the job site or kept with the building permit and must be made available for all applicable inspections. The inspector should verify certificate(s) of installation during the applicable site inspections (for example, verifying the certificates of installation for quality insulation installation, QII, at the framing and insulation inspections). Do not wait until the final inspection to check all CF2R documentation.

(b) The general contractor or his/her agent (for example, the installing contractor) must complete and sign the CF2R form for the work performed. A homeowner acting as the general contractor for a project is authorized to sign the CF2R. The installing contractor should provide the certification since the CF2R certification statement is an installer's assurance to the owner that the work has been completed properly and complies with applicable codes and regulations. The CF2R certification statement and signature indicates that the equipment or feature 1) was installed properly and confirms that the information provided on the form properly identifies the installed building component or equipment, 2) is equivalent or more efficient than required by the approved plans (as indicated on the CF1R), and 3) meets all relevant certification or performance requirements.

Refer to §10-103(a)3 for more information about certificate of installation requirements.

## 2.5 HERS Field Verification and Diagnostic Testing

This section describes some procedures and requirements for field verification and/or diagnostic testing of energy efficiency features.

Field verification and diagnostic testing are performed by special third-party inspectors called HERS Raters. The Energy Commission has given this responsibility to the raters, who must be specially trained and certified to perform these services. The raters cannot be employees of the builder or contractor whose work they are verifying. Also, they cannot have a financial interest in the builder's or contractor's business, or advocate or recommend the use of any product or service that they are verifying. The training, quality assurance, and general oversight of the raters are conducted by Energy Commission-approved HERS Providers.

### 2.5.1 Measures Requiring HERS Field Verification and Diagnostic Testing

Field verification and diagnostic testing are required only 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 are 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.

The following features require field verification and/or diagnostic testing:

- a. Duct sealing
- b. Duct location, surface area and R-value
- c. Low-leakage ducts entirely in conditioned space
- d. Low-leakage air handlers
- e. Verification of return duct design
- f. Verification of air filter device design, filter MERV rating, and labeling
- g. Verification of prescriptive bypass duct requirements
- h. Refrigerant charge in ducted split-system and ducted packaged unit air conditioners and heat pumps, and mini-split systems
- i. Refrigerant fault indicator display (FID)
- j. Verified system airflow

- k. Air handler fan efficacy
- l. Verified energy efficiency ratio (EER)
- m. Verified seasonal energy efficiency ratio (SEER)
- n. Heat Pump Rated Heating Capacity
- o. Evaporatively cooled condensers
- p. Whole-house fan
- q. Central fan ventilation cooling systems
- r. Continuous whole-building mechanical ventilation airflow
- s. Intermittent whole-building mechanical ventilation airflow
- t. Kitchen range hood verification
- u. Building envelope air leakage
- v. Quality insulation installation (QII)
- w. Quality insulation installation for spray polyurethane foam
- x. Verified pipe insulation credit (PIC-H)
- y. Verified central parallel piping (PP-H)
- z. Verified compact hot water distribution system expanded credit (CHWDS-H-EX)
- aa. Demand recirculation: manual control (R-DRmc-H)
- ab. Demand recirculation: sensor control (R-DRsc-H)
- ac. Multiple recirculation loop design for DHW systems serving multiple dwelling units
- ad. Verified drain water heat recovery system (DWHR-H)

### **2.5.2 Verification, Testing, and Sampling**

At the builder's option, HERS field verification and diagnostic testing may be completed for each dwelling unit or for a sample of dwelling units. Sampling is permitted only when multiple dwelling units of the same type are constructed within the same subdivision by the same subcontractor. Sampling may also be used for alterations for groups composed of dwellings having the same measure installed that requires HERS verification, and where the same installing contractor has installed the measures. More details are in Reference Residential Appendix Section RA2.6 and RA2.8.

The builder or subcontractor must provide to the rater a copy of the certificate of compliance approved/signed by the principal designer/owner and a copy of the certificate(s) of installation signed/certified by the builder or subcontractors as specified in Reference Residential Appendix Section RA2.5.

When compliance requires document registration, prior to performing field verification and diagnostic testing, the rater must verify that transmittal to the data registry of the CF1R and CF2R information has been completed for each dwelling unit for which compliance requires HERS verification.

For all HERS verification procedures, the rater must confirm that the certificate(s) of installation have been completed as required and that all other information show compliance consistent with the requirements given in the plans and specifications and certificate of compliance approved by the local enforcement agency.

If field verification and diagnostic testing determines that the requirements for compliance are met, the HERS Rater shall transmit the test results and certification/signature to the data registry. The provider shall make available a registered copy of the completed and signed certificate of verification to the rater, the builder, the enforcement agency, and other approved users of the HERS registry. Printed copies, electronic or scanned copies, and photocopies of the completed, signed and registered certificate of verification shall be allowed for document submittals, subject to verification that the information contained on the copy conforms to the registered document information currently on file in the data registry. A completed, signed and registered copy of the certificate of verification must be posted at the building site or made available for review by the enforcement agency in conjunction with requests for final inspection for each dwelling unit.

The HERS Provider shall make available via phone or Internet a way for building officials, builders, HERS Raters, and other authorized users of the data registry to verify that the information displayed on copies of the submitted certificate(s) conforms to the registered document information on file in the registry for the dwelling unit.

If the builder chooses the sampling option, the procedures in Reference Residential Appendix Sections RA2.6 and RA2.8 must be followed.

### **2.5.3 Initial Model Field Verification and Diagnostic Testing**

The HERS Rater must diagnostically test and field verify the first dwelling unit of each model within a subdivision or multifamily housing development. To be considered the same model, dwelling units must have the same basic floor plan layout, energy design, and compliance features as shown on the certificate of compliance for each dwelling unit. Variations in the basic floor plan layout, energy design, compliance features, zone floor area, or zone volume, that do not change the HERS features to be tested, the heating or cooling capacity of the HVAC unit(s), or the number of HVAC units specified for the dwelling units shall not cause dwelling units to be considered a different model. For multifamily buildings, variations in exterior surface areas caused by location of dwelling units within the building shall not cause dwelling units to be considered a different model.

The initial model testing allows the builder to identify and correct any potential construction flaws or practices in the build out of each model. If field verification and diagnostic testing determines that the requirements for compliance are met, the HERS Rater will transmit the test results to the data registry. The provider will make available a registered copy of the certificate of verification to the rater, the builder, the enforcement agency, and other authorized users of the data registry.

### **2.5.4 Group Sample Field Verification and Diagnostic Testing**

After the initial model field verification and diagnostic testing are completed, the builder or the builder's authorized representative determines which sampling procedure is to be used for the group of dwellings that require HERS field verification. There are two procedures for HERS verification compliance using group sampling: (1) sampling a closed group of up to seven dwellings; and (2) sampling of an open group of up to five dwellings. The group sampling requirements for each procedure will be discussed in this section.

Transmittal/submittal of the certificate(s) of installation information, for at least one dwelling, to the HERS registry is required to open a new group. Additional dwellings may be entered into the registry and included in an "open" group over a specific period, subject to transmittal/submittal of the certificate(s) of installation information to the registry for each additional dwelling. However, the group shall not remain open to receive additional dwellings for a period longer than six months from the earliest date shown on any certificate of installation for a dwelling included in a group. A group may be closed at any time after the group has been opened at the option of the builder or builder's authorized representative. The size of a closed group may range from a minimum of one dwelling to a maximum of seven dwellings. When a group is closed, no additional dwellings shall be added to the group.

- A. Sampling of a closed group of up to seven dwellings requires the following conditions to be met as prerequisite to receiving HERS compliance verification for the group:
1. All the dwelling units in the sample group have been identified. Up to seven dwellings are allowed to be included in a closed sample group.
  2. Installation of all the measures that require HERS verification has been completed in all the dwellings in the group, and registration of the certificate(s) of installation for all the dwellings has been completed.
  3. The group has been classified as a closed group in the data registry.
  4. At the request of the builder or the builder's authorized representative, a rater will randomly select one dwelling unit from the closed sample group for field verification and diagnostic testing. If the dwelling unit meets the compliance requirements, this tested dwelling and each of the other nontested dwellings in the group will receive a registered certificate of verification.
- B. Sampling of an open group of up to five dwellings requires the following conditions to be met as prerequisite to receiving HERS compliance verification for the group:
1. At least one dwelling unit from the sample group has been identified. Up to five dwellings are allowed to be included in an open sample group.
  2. Installation of all the measures that require HERS verification shall be completed in all the dwellings. Registration of the certificate(s) of installation for all the dwellings has been completed.
  3. At the request of the builder or the builder's authorized representative, a rater will randomly select one dwelling unit from the open sample group for field verification and diagnostic testing. If the dwelling unit meets the compliance requirements, the tested dwelling and each of the other nontested dwellings shall receive a registered certificate of verification. If there are fewer than five dwelling units, the group shall be allowed to remain open and eligible to receive additional dwelling units. Dwelling units entered into the open group after the successful HERS compliance verification of the tested dwelling shall also receive a registered certificate of verification as a nontested dwelling subject to receipt of the registered certificate(s) of installation by the data registry for the dwelling. The group shall be closed when it reaches the limit of five dwellings, when the six-month limit for open groups has been exceeded, or when the builder requests that the group be closed.

The rater must confirm that the certificate(s) of installation have been completed as required and that the installer's diagnostic test results and the certificate(s) of

installation show compliance consistent with the certificate of compliance for the dwelling unit.

The rater must diagnostically test and field verify the selected dwelling unit and enter the test and/or field verification results into the data registry regardless of whether the results indicate a pass or fail. If the test fails, then the failure must be entered into the provider's registry, even if the installer immediately corrects the problem. In addition, any applicable procedures for resampling, full testing, and corrective action must be followed as described in Section 2.5.5 below.

If field verification and diagnostic testing determine that the requirements for compliance are met, the HERS Rater will enter the test results into the data registry. The provider will make available to the rater, the builder, the enforcement agency, and other approved users of the data registry a registered copy of the certificate of verification for the tested dwelling and for all other nontested dwelling units in the group at the time of the sample test. In order not to create confusion by placing test results on nontested dwelling units, the data registry will not report the testing/verification results of the tested home on the certificate of field verification and diagnostic testing for nontested dwelling units in a sample group. The results will be reported only on the CF3R for the tested dwelling unit of the sample group. However, CF3R forms for nontested dwelling units will still have a registration number and date and a watermark of the provider's seal and so forth and will specify the dwelling unit was not tested and is part of a sample group.

The provider must close any open group within six months after the earliest signature date shown on any certificate of installation for a dwelling entered in the group. When such group closure occurs, the provider shall notify the builder that the group has been closed and require that a sample dwelling be selected for field verification and diagnostic testing by a rater if field verification has not yet been conducted on a sample dwelling entered in the group.

### **2.5.5 Resampling, Full Testing, and Corrective Action**

When a failure is encountered during sample testing, the failure must be entered into the data registry for retention by the HERS Rater. Corrective action must then be taken on the failed dwelling unit, and the dwelling unit must subsequently be retested to verify that corrective action was successful and the dwelling complies. Corrective action and retesting on the dwelling unit must be repeated until the testing determines that the dwelling complies and the successful compliance results have been entered into the HERS registry. A registered certificate of verification for the dwelling shall be made available to the rater, the builder, the enforcement agency, and other authorized users of the data registry.

In addition, the rater must resample and test a second randomly selected dwelling within the sample group to assess whether the first failure is unique or if the rest of

the dwelling units are likely to have similar failings. Resampling is the procedure that requires testing of additional dwellings within a group when the initial selected sample dwelling from a group fails to comply with verification requirements.

When resampling in a closed group, if the testing of a second randomly selected dwelling in the group confirms that the requirements for compliance credit are met for that unit, then the unit with the initial failure does not indicate failure in the remaining untested units. A copy of the CF3R will be made available for the remaining dwelling units in the group, including the unit in the resample. If the second sample results in a failure, the rater must report the second failure to the data registry. All the nontested units in the group must be individually field verified and diagnostically tested.

Additional information is in Reference Residential Appendix RA2.6.

### **2.5.6 Installer Requirements and HERS Procedures for Alterations**

When compliance for an alteration requires field verification and diagnostic testing by a certified HERS Rater, the building owner may choose for the field verification and diagnostic testing to be completed for each dwelling unit or as part of a designated sample group of dwelling units for which the same installing company has completed work that requires testing and field verification for compliance. The only alterations that will require HERS testing/verification are HVAC changeouts. The building owner or agent of the building owner must complete the applicable portions of a shorthand version of the certificate of compliance (the CF1R-ALT) form for his or her climate zone. When compliance requires verification, the building owner or agent must arrange for transmittal/submittal of the certificate of compliance information to the data registry, identifying the altered HVAC system and measures that require verification. The building owner must also submit an approved/signed copy of the certificate of compliance to the rater.

When the installation is complete, the person responsible for the performance of the installation must complete the certificate(s) of installation (CF2R). All required certificate(s) of installation must be registered with an approved data registry when field verification and diagnostic testing are required.

After verifying that the certificate of compliance (CF1R-ALT) and all required certificate(s) of installation are completed, signed, and registered, the rater must verify compliance. If group sampling is used for compliance, the sampling procedures described in Reference Residential Appendix RA2.6.3.3 and RA2.8, for sampling of a closed group of up to seven dwellings must be used. It requires that all dwelling units (HVAC systems) within the group have been serviced by the same installing company. The installing company may request a group for sampling that is smaller than seven dwelling units (HVAC systems). Resampling, full testing, and



corrective action must be completed, if necessary, as specified by Reference Residential Appendix RA2.6.4.

Whenever the HERS Rater for the group is changed, a new group must be established.

The enforcement agency cannot approve the alteration until the agency has verified completed, signed and registered certificate of compliance (CF1R-ALT), certificate(s) of installation, and certificate(s) of verification documentation for the altered HVAC system. The agency shall also verify that the installing contractor provides copies of all of these forms to the homeowner.

TPQCP, as specified in Reference Residential Appendix RA2.7, may also be used with alterations and must be limited to closed sample group sizes of 30 dwelling units (HVAC systems) or fewer. When a TPQCP is used, the enforcement agency may approve compliance based on the certificate(s) of installation (CF2R), where data checking has indicated that the unit complies, on the condition that if the required HERS verification procedures determine that resampling, full testing, or corrective action is necessary, such work shall be completed.

### **2.5.7 For More Information**

More details on field verification and/or diagnostic testing and the HERS provider data registry are in the *2019 Reference Residential Appendices and 2019 Reference Joint Appendices*, as described below:

1. Reference Joint Appendix JA7 – Data Registry Requirements
2. Reference Residential Appendix RA2 – Residential HERS Verification, Testing, and Documentation Procedures
3. Reference Residential Appendix RA3 – Residential Field Verification and Diagnostic Test Protocols

#### **Example 2-9**

##### **Question**

Given a multifamily building that has ducted HVAC systems and HERS verified duct leakage verification for all the dwelling units in the building, what is the correct sampling procedure for HERS field verification and diagnostic testing for the air distribution ducts?

##### **Answer**

If the builder of a multifamily building chooses to comply using sampling, then the sampling is done using groups composed of dwelling units that have used the same HERS measures for compliance. Dwellings that do not have the same HERS measures specified for compliance are not allowed to be placed in the same HERS sample group. If the whole-building compliance approach has been used, all dwellings in the building have the same HERS features specified. However, if unit-by-unit compliance approach has been used, and all dwellings do not use the same HERS features for compliance, then only the dwellings that have used the same HERS features may be grouped together.

For this example, since duct testing is the only HERS measure specified for all the dwelling units, all the dwelling units in the building can be grouped together for HERS verification requirements. The procedures for assigning dwellings to groups and the HERS verification of a sample from each group must follow the same procedure as for single-family dwellings described in Section 2.5.2 in this chapter and in Reference Residential Appendix RA2. The first dwelling unit for each model floor plan in the building must be verified by the rater before the start of formation of sample groups.

For multifamily buildings, variations in exterior surface areas caused by location of dwelling units within the building do not cause dwelling units to be considered a different model floor plan. When verifying a dwelling unit, all the duct systems associated with every HVAC unit in the dwelling must be tested to determine compliance for that dwelling. After the verification of the first dwelling of each model floor plan is complete, the rater must randomly select a sample dwelling unit from each group of dwellings that have been formed. These samples must be tested according to applicable procedures in Reference Residential Appendix RA3 and documented according to procedures in Reference Residential Appendix RA2. In a sampled dwelling unit that is to be tested to confirm compliance, the duct system associated with every HVAC unit in that dwelling unit must be tested. However, duct systems do not have to be tested in dwelling units that are not selected for sampling (nontested dwelling), provided the dwelling that was tested complies.

If the tested dwelling in the group complies with the verification, the remaining dwellings in the sample group are certified for compliance based on the results of the sample dwelling test result. Testing must be done on every duct system in a dwelling unit, regardless of whether it appears that the HVAC and duct system are in conditioned space. This is akin to a single-family residence with one HVAC unit serving upstairs with ducts in the attic and another serving downstairs with ducts between floors.

Defining duct location as inside or outside for leakage purposes is not described by the locations of walls or the number of stories. The boundary between inside and outside for leakage purposes is defined by the air boundary, typically drywall, between inside and outside. Spaces between floors and spaces in walls (including interior walls) are often outside from an air leakage perspective because they are not sealed effectively to form an air barrier and communicate to the outside.

Duct insulation is not required for ducts in directly conditioned space because there is an expectation that there will be reduced conduction losses for these ducts. To get full credit for ducts in conditioned space, duct leakage must be tested and meet the requirements for duct sealing. In a multifamily building, for compliance credit to be taken for ducts in conditioned space, all the duct systems in the building must be in conditioned space unless compliance is documented for each dwelling unit separately. To meet the mandatory requirements, all HVAC units must have ducts made of UL 181 approved materials (that is, cased coils). Coils enclosed by sheetrock do not meet the mandatory requirements.