2016

DATA REGISTRY REQUIREMENTS MANUAL

FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS

TITLE 24, PART 6, AND ASSOCIATED ADMINISTRATIVE REGULATIONS IN PART 1.

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The Building Energy Efficiency Standards (Standards) were first adopted and put into effect in 1978 and are updated periodically. The Standards are a unique California asset and have benefitted from the conscientious involvement and enduring commitment to the public good of many people and organizations along the way. The 2016 Standards development and adoption process continued that long-standing practice of maintaining Standards with technical rigor, challenging but achievable design and construction practices, public engagement, and full consideration of stakeholder knowledge and opinions. The 2016 Standards revisions were conceptualized, evaluated, and executed through the dedicated work of Energy Commission staff and consultants.

This *Data Registry Requirements Manual* was created by Energy Commission staff including Jeff Miller, PE; Maziar Shirakh, PE; Todd Ferris; and Michael Shewmaker. Other key technical staff contributors included Mark Alatorre, PE; Payam Bozorgchami, PE; Simon Lee; Farakh Nasim; Rashid Mir, PE; Dee Anne Ross; and Danny Tam. Eurlyne Geiszler, Manager of the Building Standards Office, provided overall guidance to the staff and consultants. Efficiency Division Deputy Director Dave Ashuckian, PE and Deputy Division Chief Christine Collopy provided policy guidance. Pippin Brehler and Galen Lemei provided expert legal counsel.

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ABSTRACT

Public Resources Code Section 25402 was enacted in 1975 as part of the enabling legislation establishing the California Energy Commission and its basic mandates. This section requires the Energy Commission to adopt, implement, and periodically update energy efficiency standards for both residential and nonresidential buildings.

The Building Energy Efficiency Standards must be cost effective based on the life cycle of the building, must include performance and prescriptive compliance approaches, and must be periodically updated to account for improvements in efficiency technology. Accordingly, the Energy Commission has adopted and periodically updated the Standards (codified in Title 24, Part 6, of the California Code of Regulations) to ensure that building construction, system design and installation achieve energy efficiency goals and preserve outdoor and indoor environmental quality.

California Title 24, Part 6 Building Energy Efficiency Standards compliance documents are utilized to enforce the Standards requirements during the design, construction or installation, and field verification phases.

The 2016 Standards include requirements for compliance documents to be electronic documents registered by Residential or Nonresidential Data Registries utilizing Energy Commission-approved specifications for standardized document layouts, standardized XML-based data inputs, and standardized data transmission protocols. Data Registries are required to collect information to confirm an applicant's professional credentials and may authorize password-protected Data Registry accounts with associated electronic signature authority to qualified users. Compliance documents that are completed and electronically signed by authorized users are subsequently signed digitally by the Data Registries enabling use of digital certificate technology to validate the authenticity of these documents after they are submitted to enforcement agencies or other parties to the construction project.

Energy Commission-approved Data Registries are expected to provide energy code compliance document registration services to the public, retain a copy of each registered document, and make registered documents available to authorized users. Contingent upon approval of a document repository by the Energy Commission, each newly-registered compliance document is transmitted to an Energy Commission-managed document repository for retention for use as evidence in legal proceedings, for complying with public information requests, and as a resource for building energy efficiency research.

This *Data Registry Requirements Manual* provides additional detailed guidance regarding the functional and technical aspects of the Data Registry requirements given in the *2016 Reference Joint Appendix JA7*, CEC-400-2015-038-CMF. The guidance in this manual is expected to be used by Data Registry technical staff for creating Data Registry software capabilities that enable their users to register standardized data and compliance documentation sufficient to demonstrate compliance with Title 24, Part 6.

Keywords: DRRM, Data Registry Requirements, Compliance Document, Document Registration, Building Energy Efficiency Standards, California Energy Commission, Energy Commission, Certificate of Compliance, CF1R, Certificate of Installation, CF2R, Certificate of Verification, CF3R, NRCV, Certificate of Acceptance, NRCA, Digital Signature, Electronic Signature.

TABLE OF CONTENTS

1 Introduction 1

1.1 Purpose and Scope 1

1.2 Documents Relied Upon 1

1.3 Definitions for Terminology used in this Manual 2

2 Standardized Data and Electronic Documents 3

2.1 Overview 3

2.2 Report Generator Web Service 3

2.3 Report Generator Versioning Procedures: 5

2.3.1 Version Scope and Numbering Convention 6

2.3.2 Version Development Stage 7

2.3.3 Version Testing Stage 7

2.3.4 Version Deployment to Production Stage 8

2.3.5 Urgent or Emergency "Patch" Modifications to Report Generator Versioning Procedures 9

2.3.5.1 Modification of the Scope of a Version in the Development Stage 9

2.3.5.2 Modification of the Scope of a Version in the Testing Stage 10

2.3.5.3 Deploying an Emergency "Patch" to a Version in the Production Stage 10

2.3.5.4 Patches to Report Generator software 11

2.3.5.5 Patches to Data Registry Software 12

2.4 Compliance Document Design Files (Appendix A) 12

2.4.1 Graphical Layout 13

2.4.2 User Instructions 13

2.4.3 Data Field Definitions and Calculations (Pseudocode) 13

2.4.4 Versioning 13

2.5 Compliance Document XML Schemas (XSD) (Appendix B) 14

2.5.1 SharePoint Schema Lists 14

2.5.1.1 Purpose 14

2.5.1.2 Versioning 15

2.5.2 Schema Generation Microsoft Excel Workbooks and Macros 15
2.5.2.1 Purpose 15
2.5.2.2 Versioning 15
2.5.3 XML Schemas for SDD Base Set and Compliance Document Schemas 15
2.5.3.1 Purpose 15
2.5.3.2 XML Schema Version Attribute 15
2.5.3.3 Schema Generation Code Version 15
2.5.3.4 Schema Versioning Procedures 16
2.5.3.5 SVN Version Control 16
2.5.4 Policies for Major and Minor Versioning 16
2.5.4.1 Major Versioning Policy 16
2.5.4.2 Backward Compatible Minor Version Policy 16
2.5.4.3 Examples of Backward Compatible Changes to Existing Schemas 16
2.5.4.4 Use Case: Backward Compatible Minor Version Release 17
2.5.4.5 Non-Backward Compatible Major Version Policy 17
2.5.4.6 Issue Severity of Non-backward Compatible Changes 17
2.5.4.7 Disruptiveness of the Non-backward Compatible Change 17
2.5.4.8 Examples of Non-backward Compatible Changes 18
2.5.4.9 Use Case: Non-Backward Compatible Major Version Release 18
2.6 Compliance Document XSL Templates 19
3 Document Registration Processes 21
3.1 Overview 21
3.2 Data Validation Requirements for Data Registries 21
3.3 Document Registration Prerequisite Rules 22
3.3.1 Document Configuration Rules 22
3.3.2 Data Field Definition Rules 23
3.3.3 Data Security and Authentication Rules for the Performance Certificate of Compliance Transmission Package 24
3.4 Residential Registration Numbering Conventions 25

3.4.1 Document Type Designators 25
3.4.2 Numbering Convention for CF1R, CF2R, CF3R, and NRCV Documents 27
4 Electronic Signatures 32
4.1 Overview 32
4.2 Establishing a User Account and Signature Authority 32
4.3 Data Field Definitions for Signature Blocks 33
4.3.1 Electronic Images and Fonts Used for Electronic Signatures 33
4.3.2 Signature Block Data Validation 33
4.3.3 Appending the Signature Block Data 33
4.4 Electronic Signature Process Flow 34
4.5 Delegated Signatures and Authorized Representatives 35
4.5.1 Delegation of Signature Authority for Certificates of Installation 35
4.5.2 Signature Block Data for Delegated Signatures 36
5 Digital Signatures and Certificate Authorities 37
5.1 Overview 37
5.2 Digital Certificates and Certificate Authorities 37
5.3 Document Components That Must Be Digitally Signed 38
5.3.1 Digital Signing Requirements for the Registered Compliance Document PDF 39
5.3.2 Digital Signing Requirements for the Transmission Package 39
5.3.3 Digital Signature Appearance. 39
5.3.3.1 The Content of the Digital Signature Appearance 40
5.3.3.2 Placement of Digital Signature Appearance 40
5.4 Considerations for Data Registry Digital Certificate Solutions 41
5.4.1 Digital Certificates for use by Data Registry Providers 41
5.4.2 Manual Signing 42
5.4.3 Automatic Signing 42
5.4.4 Typical Vendor Pricing 42
5.4.5 California Secretary of State Approved CAs and Adobe's Approved Trust List of CAs 43

5.5 CBECC Software Output Data Security and Authentication for the Performance Certificate of Compliance 43

5.6 Report Generator Output Data Security and Authentication for the Performance Certificate of Compliance 44

6 Document Configuration Rules 45

6.1 Overview 45

6.2 Project Status Reports 45

6.2.1 Project Status Report Requirements specified in *2016 Reference Joint Appendix JA7* 45

6.2.1.1 Project Status Reports (from JA7.5.6.1) 45

6.2.1.2 Project Status Report Information for Residential Projects (from JA7.5.6.1.1) 45

6.2.1.3 Project Status Report Information for Nonresidential Projects (from JA7.5.6.1.2): 46

6.2.2 Additional Guidance for Producing Residential Project Status Reports 46

6.2.2.1 Mandatory Measure Compliance Alternatives Determined at Installation Phase 46

6.2.2.2 Reporting Non-default Data Inputs 47

6.2.2.3 Delayed HERS Verification of Refrigerant Charge 49

6.3 General Configuration Rules 51

7 Group Sampling Rules for HERS Verification Compliance 70

7.1 Overview 70

7.2 General Group Sampling Rules 70

7.2.1 Group sampling rules specified in *2016 Residential Appendix RA2* 70

7.2.1.1 Designation of Groups (from 2016 RA2.6.3.1) 70

7.2.1.2 Group Status - "Open" Groups and "Closed" Groups (from 2016 RA2.6.3.2) 71

7.2.1.3 Sampling of a “Closed” Group of Up to Seven Dwellings (from 2016 RA2.6.3.3) 72

7.2.1.4 Sampling of an “Open” Group of Up to Five Dwellings (from 2016 RA2.6.3.4) 72

7.2.1.5 Additional Requirements Applicable to Group Sampling Procedures (from 2016 RA2.6.3.5) 73

7.2.2 Additional Guidance for Group Sampling Procedures and Documentation 75

7.2.2.1 Certificate of Verification Documentation for Not-tested Dwellings in a Sample Group 75

7.2.2.2 Group Sampling Rules Applicable to Specific 2016 Compliance Documents and HERS Features 76

Appendix A
Compliance Document Design Files: Graphical Layouts, User Instructions, Data Field Definitions, and Calculations

Appendix B
Compliance Document XML Schema Files (XSD)

FIGURES

Figure 2-1: Process Flow Diagram for the Data Registry Interface with Report Generator 5
Figure 2-2: Report Generator and Document Schema Version Numbering Convention 6
Figure 3-1. Numbering Convention for CF1R Worksheets 28
Figure 3-2. Numbering Convention for CF1R, CF2R, CF3R, and NRCV Documents 29
Figure 5-1: Process Flow Diagram for Digitally Signing a Document, and Verifying the Digital Signature 41

TABLES

Table 3-1. Category Designators for Use with Registration Numbers 26
Table 5-1: California Secretary of State's List of Approved Certificate Authorities 43
Table 6-1: Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features 51
Table 7-1: Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features 76

1 Introduction

1.1 Purpose and Scope

The *2016 Reference Joint Appendix JA7* specifies required functional and technical elements for Residential and Nonresidential Data Registries that provide services to authorized Data Registry users and receive data to produce, register, retain, and distribute copies of the Building Energy Efficiency Standards (Standards) compliance documents required by California Title 24, Part 6.

This *Data Registry Requirements Manual* (DRRM) provides additional detailed guidance regarding the functional and technical aspects of the requirements given in *Reference Joint Appendix JA7*. Data Registry Providers may refer to this Manual for additional guidance beyond what is specified in *Reference Joint Appendix JA7* for implementation of software procedures and user interface features for their Data Registries.

Note: At the time of publication of this DRRM there are no approved Nonresidential Data Registries. At such time as the Energy Commission approves a Nonresidential Data Registry, additional information will be included in this DRRM to provide the needed guidance for implementing the Nonresidential Data Registry requirements.

1.2 Documents Relied Upon

This Data Registry Requirements Manual relies upon information found in the following documents:

- *2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-037-CMF*
- *2016 Reference Appendices for Residential and Nonresidential Buildings. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-038-CMF*
- *2016 Residential Alternative Calculation Method Reference Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-024-SF*
- *2016 Nonresidential Alternative Calculation Method Reference Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-025-SF.*
- *2016 Residential Compliance Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-032*

- *2016 Nonresidential Compliance Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2015-033*

1.3 Definitions for Terminology used in this Manual

Definitions for some terms used in this *Data Registry Requirements Manual* may be found in the following documents as detailed below:

- 2016 Title 24, Part 1, Standards Section 10-102
- 2016 Title 24, Part 6, Standards Section 100.1
- 2016 Title 24, Part 6, Reference Joint Appendix JA1
- 2016 Title 24, Part 6, Reference Joint Appendix Section JA7.2

2 Standardized Data and Electronic Documents

2.1 Overview

The Building Energy Efficiency Standards (Standards) are administered and enforced utilizing compliance documents specific to each of the phases of a construction project. The Certificate of Compliance is applicable to the design phase of the project and is submitted to the enforcement agency by the person responsible for the building/system design at the time of application for the building permit. The Certificate of Installation is applicable to the installation/construction phase of the project and is posted, or made available to the enforcement agency by the person responsible for the installation/construction after the installation/construction has been completed. The Certificate of Verification is applicable to the HERS verification phase of the project and is posted, or made available to the enforcement agency by the HERS Rater who performed the verification services. The Certificate of Acceptance is applicable to the acceptance testing phase of a nonresidential project and is posted, or made available to the enforcement agency by the Acceptance Test Technician who performed the acceptance test.

To standardize the documents created by multiple Data Registries and multiple compliance software tools, the 2016 Standards specify use of standardized schemas for each of the compliance documents, and require that documentation created by permit applicants, building designers, building construction contractors, and HERS Raters shall be registered by a Data Registry approved by the Energy Commission prior to submittal of the documents to the enforcement agency. PDF format compliance documents are produced by a single-point web service maintained by the Energy Commission referred to as the Compliance Report Generator (also called Report Generator or RG). The RG enforces compliance with the standardized schemas for each of the compliance documents as part of the document registration process.

Note: the requirement for registration of nonresidential compliance documents is contingent upon approval of nonresidential Data Registry(s) by the Energy Commission as specified by Standards Section 10-103.

2.2 Report Generator Web Service

The RG receives standardized document data exchange files from Energy Commission-approved software applications and produces the document registration package required to complete the registration of compliance documents in Data Registries. The RG provides standardized reporting services for the following:

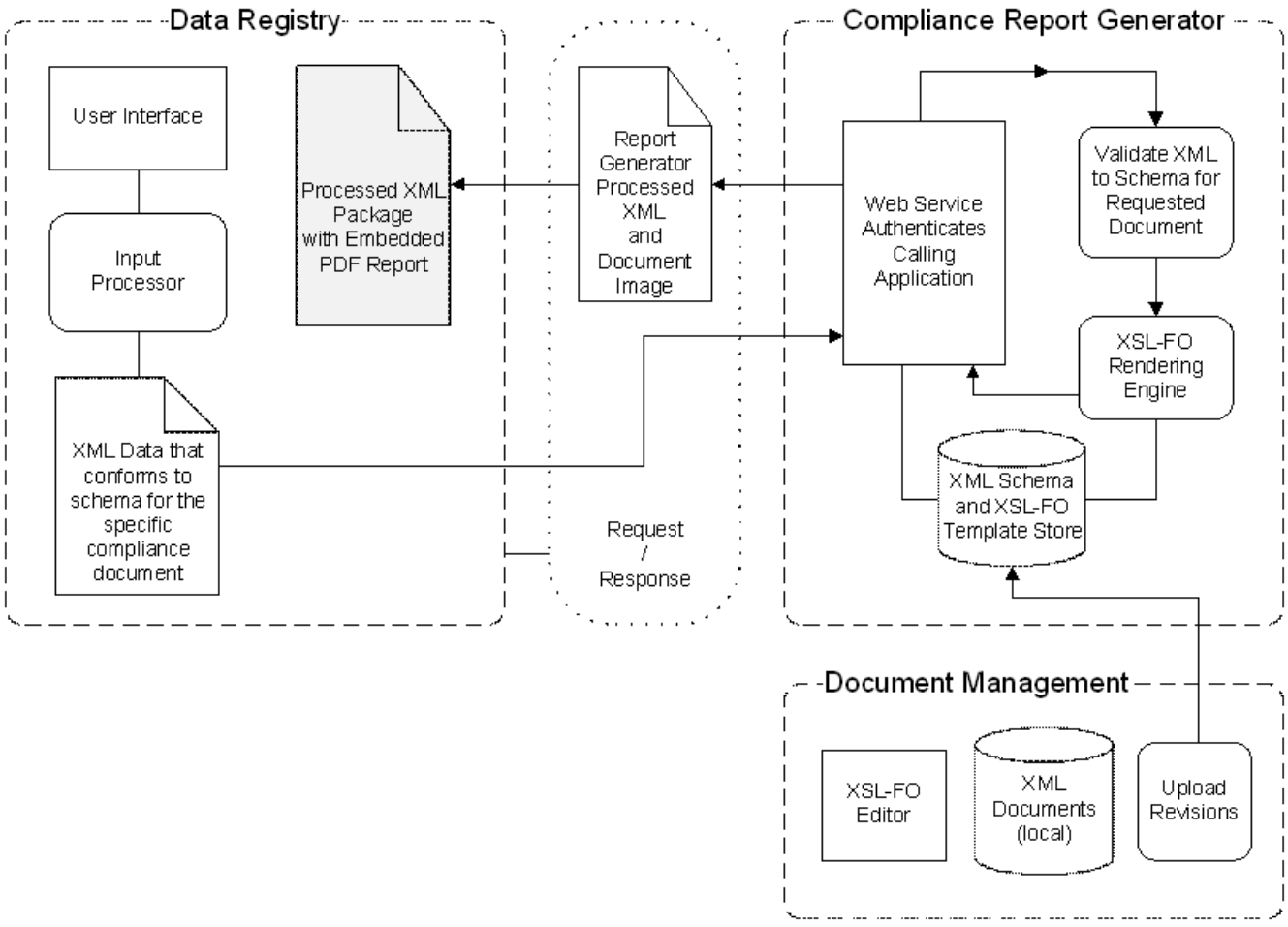
- California Building Energy Code Compliance (CBECC) Residential compliance software and all third-party vendor users of CBECC-Res.
- CBECC Nonresidential compliance software and all third-party vendor users of CBECC-Comm.
- Residential Data Registry compliance document registration software operated by Residential Registration Providers that are also HERS Providers.
- Nonresidential Data Registry compliance document registration software operated by Nonresidential Registration Providers. Note: the requirement for registration of nonresidential compliance documents is contingent upon approval of Nonresidential Data Registry(s) by the Energy Commission as specified by Standards Section 10-103.

The RG is a web-based, service-oriented application implemented using the Windows Communication Foundation, a distributed computing framework that runs in Windows IIS 7 (Internet Information Service). It requires a Windows Server 2008 (minimum) operating environment and is accessed via specific Uniform Resource Identifiers (URI) that allows remote clients to interact with the instance of the service that is requested. A Secure Socket Layer (SSL) connection is required and provides communication security over the Internet.

The Report Generator is implemented using Representational State Transfer (ReST) architecture style principles and is accessed using a single HTTP POST method call. This means that the instructions and data sent to the server in the URI request will be interpreted and processed to return a single response in one round trip from the client to the server and back. The Request and Response data are streams. No other type access is implemented or planned.

The Report Generator application and connected database can run on a properly configured Windows Server (2008 or later). The current implementation is deployed through Infrastructure as a Service (IaaS), a basic cloud computing service model. In this case, which is the most common type, the "computer" on which the application is running is a "virtual machine" that is controlled by a hypervisor. The hypervisor is a software platform that controls pools of computing resources for processing, storage, and networking.

Figure 2-1. Process Flow Diagram for the Data Registry Interface with Report Generator



2.3 Report Generator Versioning Procedures:

To allow for changes to the standardized compliance document schemas and XSL templates utilized by the Report Generator, the deployment of the RG web service is segregated into separate instances of the RG operating on separate servers at separate URLs as follows:

- **Report Generator Development Site**
  The RG development site is accessible only to Energy Commission staff and technical contractors. This instance of the RG is used for initial testing of new and revised XSD and XSL files used by the RG prior to making the revised files available to the Data Registries.

- **Report Generator Test Site**
  The RG test site is accessible by any Registration Provider that has been approved by the Energy Commission, or by any prospective Registration Provider being considered for approval by the Energy Commission. This instance of the RG is used for testing Data Registry user interfaces and Data Registry document registration results as part of the Data Registry approval process. This site is also used for vetting revisions to XSD and XSL files prior to release of new RG software versions to the RG production site.
- **Report Generator Production Site**
  The RG production site is accessible by any Energy Commission-approved Data Registry Provider. This instance of the RG is used for production of documentation that can be registered and used for submittal to enforcement agencies.

When revisions to existing standardized document schemas or XSL templates become necessary, the following procedures should be adhered to, to provide for adequate functional testing by technical staff responsible for RG maintenance, and to allow for vetting of the revisions by participating Registration Providers prior to deployment of the revised files for use for production of registered compliance documents.

2.3.1 Version Scope and Numbering Convention

When revision to existing standardized document schemas or XSL templates becomes necessary, Energy Commission staff and technical consultants should identify in writing the affected file names and the changes that are to be made to these files. Once the version scope has been determined and documented, any further changes to the scope should not be made except as described in section 2.3.5. The new version should be identified by incorporating the schema version number determined according to the policies described in Section 2.5.4. The numbering convention and examples are described below.

Figure 2-2. Report Generator and Document Schema Version Numbering Convention

Text included in RG URL	Title 24 Standards Version Year	RG and Schema Major Version Number	RG and Schema Minor Version Number
DocsV	2016	x	xxx

Examples:

DocsV2016.x.xxx

The numeric digits represented in the numbering convention should be sequential, beginning with DocsV2016.1.000 for the first major version, progressing through DocsV2016.1.999 for subsequent minor versions. For the second major version the numbering begins with DocsV2016.2.000 progressing through DocsV2016.2.999 for subsequent minor versions, etc. The major version is a number series starting at 1 with no leading zeroes and no limit on the number of digits. The minor version is fixed at three digits with the leading zeroes showing as applicable (e.g. 001, 002, 003, etc.) Note: Major and minor versioning policies are described in Section 2.5.4.

When updates are made to the Standards, the year associated with the new update will be incorporated into the numbering convention (e.g., for the compliance documents applicable to the 2019 update to the Title 24, Part 6, Standards, use: DocsV2019.x.xxx).

2.3.2 Version Development Stage

Once the scope of a batch of revisions for a new version has been identified and documented, Energy Commission staff and technical consultants should coordinate to make the changes to all applicable files including the "pseudocode" and layout in document design files, XSD schema files, and XSL template files. Any XSD or XSL files used directly by the RG that are changed must be checked/tested using the Report Generator development site, to confirm the data validation and ensure the functionality is correct for all affected documents. When testing confirms all changes are validating and the functionality conforms to expectation, these new files can be deployed to the Report Generator testing site for vetting by the Data Registries.

2.3.3 Version Testing Stage

Release of a new batch of revisions to the Report Generator testing site should be accompanied by communications to all affected Data Registry Providers giving a listing of all changed files, a description of the changes, and the RG Docs version number for the batch of revisions.

Release of a new batch of revisions to the Report Generator testing site should also be accompanied by a commit of the revised files to the Energy Commission's subversion (SVN) repository, hosted at Unfuddle.com, thus making the revised files available for use by Data Registry Providers and providing a method for revision tracking and version control. Additional information about the repository and its content is given in Section 2.5 and Appendix B.

Additionally, the Internet address (URL) for the testing site of the new version should be revised to incorporate the updated RG Docs Version number for the new batch as shown in the examples below. This URL for the testing site should remain the same throughout the vetting/testing of the new version, and remain the same after the vetted new version has been deployed/released to the Report

Generator production site. The URL for the test site should remain active/available during the testing and also after release of the new version to the production site. When a subsequent newer version must be released to the Report Generator testing site, the URL that is made obsolete by the release of the new Testing site version should be removed from availability.

Backward compatibility for use of previous versions of the files used by the RG (previous RG Docs version numbers) will not be maintained. All calls to the RG will be required to use the current URL, thus will be required to use only the current versions of the XSD and XSL files deployed to the RG.

An example URL for RG Docs Version number DocsV2016.1.000 follows:

https://beesreporting.energy.ca.gov/DataRegistryTest**DocsV2016.1.000**/DRReportingService.svc/

When the next batch of revisions is released, the URL should be incremented, thus:

https://beesreporting.energy.ca.gov/DataRegistryTest**DocsV2016.1.001**/DRReportingService.svc/

Data Registry Providers should implement the new revisions into their Data Registry software then perform testing to confirm their revised XML data files validate and function correctly with the new RG Docs version files. If further revisions or corrections to any of the new RG Docs version files is needed, further-revised files can be deployed to the Report Generator testing site and also committed to the Energy Commission SVN repository described above in Section 2.3.3 such that testing can continue using the further-revised files. Alternatively, files for which testing found additional problems may be removed entirely from the version batch. Regardless of whether there were further changes made to files in the version batch, the RG Docs version number should not be changed for the version batch in process. A testing period of two weeks is recommended to allow sufficient time for the Registration Providers to implement the revisions and test them. Testing periods longer or shorter than two weeks may be used if needed and agreed to by the Energy Commission staff and affected Data Registry Providers. When vetting/testing by the Data Registries of the new RG Docs version is completed, the files can be deployed to the Report Generator production site.

2.3.4 Version Deployment to Production Stage

Release of a new batch of revisions to the Report Generator production site should be accompanied by communications to all affected Data Registry Providers advising them that the production site will be updated to use the new RG Docs version. A final listing of all changed files, including a description of the changes, and the RG Docs version number for the batch of revisions will be posted on the Energy Commission SVN repository for reference. The final list of changes may be the same information as

what was distributed when the batch was released to the test site but, if files were removed from the revision batch, or if there were additional modifications made during vetting/testing with the registries, this list of changes should be updated to list only the changes that were made.

The URL for the Report Generator production site should never change. When a new RG Docs version is released to the production site, the tested/vetted version at the test site is committed to the instance of the RG available at the production site URL.

2.3.5 Urgent or Emergency "Patch" Modifications to Report Generator Versioning Procedures

When there is an urgent need to make modifications to the scope of the revisions in an RG versioning procedure for which work is already in progress by Energy Commission staff or technical consultants, Energy Commission project managers must determine whether or not to modify the scope of the revisions contained in the version, taking into account the type of urgency, and the consequences of interrupting the process flow for the current versioning work. Three general categories of considerations that are applicable to determining the appropriate course of action for these urgent situations are summarized below in Sections 2.3.5.1, 2.3.5.2, and 2.3.5.3.

2.3.5.1 Modification of the Scope of a Version in the Development Stage

In the beginning of the development stage, before the schemas have been generated, negative impacts to the versioning procedure are minimal. In the beginning of the development stage, when a modification to the scope of a version is necessary, Energy Commission staff modifies the written scope for the batch of revisions in the version and distributes the revised scope information to the persons affected by the change in scope.

In the later parts of the development stage, after all the changes for a batch have been made to the base schema and the document schemas, and the schemas have been committed to the development SVN site, and work may have begun on updating the XSL documents, there may be significant negative impacts to the versioning procedure. At this point the new schema version is “locked in,” but it has not been released to the Providers for testing, so negative impacts affect only Energy Commission staff and the Energy Commission technical contractors assigned to perform the revision work for the new version. Possible negative impacts include added project costs for redoing work already completed, and additional challenge in keeping track of the changing version scope that can lead to confusion or errors. Project time and budget may be lost when changing the scope of a version in the later parts of the development stage since both XSL and XSD files may have to be revised again, and the schemas will have to be regenerated before XSL work can resume.

In the later parts of the development stage, when a modification to the scope of a version is necessary, Energy Commission staff modifies the written scope and specification of the batch of revisions in the version and distributes the revised scope information to the persons affected by the change in scope.

2.3.5.2 Modification of the Scope of a Version in the Testing Stage

In the testing stage, all the changes for the batch of revisions have been completed for the base schema, document schemas, and the XSL documents, all of which have been committed to the testing SVN site so are available to the Data Registry Providers to use. Thus at this point, the Data Registry Providers may have invested their time and resources into incorporating the revisions into their user interfaces and other document registration software processes. Therefore the possible negative impacts affect Energy Commission staff, technical contractors assigned to perform the revision work, and Data Registry Provider technical staff. Negative impacts to Data Registry Providers increase in proportion to their completion status and the complexity of the scope of the revisions. Negative impacts to all parties include added project costs for redoing already completed work, and additional challenges in keeping track of the changing version scope that can lead to confusion or errors. Significant project time and budget may be lost when changing the scope of a version in the testing stage as the change affects the Data Registry User Interface software, XSL and XSD files. Additionally, the schemas will have to be regenerated before XSL work can resume.

When determining whether or not to allow a modification to the scope of the version during the testing phase, the Energy Commission project manager must take into account the schema versioning policies described in section 2.5.4. If evaluation finds the request for a non-backward compatible change to be trivial or too disruptive, it will be added to the list of changes for the next regular major release. If evaluation finds the request for a non-backward compatible change to have a high issue severity score or a very low disruptiveness score, then final approval of the non-backward compatible change requires input from representatives of all stakeholders that use the affected schemas. If approved, the change will be implemented.

In the testing stage, when a modification to the scope of a version is necessary, Energy Commission staff modifies the written scope and specification of the batch of revisions in the version and distributes the revised scope information to the persons affected by the change in scope.

2.3.5.3 Deploying an Emergency "Patch" to a Version in the Production Stage

In the production stage, all revisions for the version have been completed, the changes have been implemented and vetted by the Data Registry Providers, and the new version has been committed to the production instance of the Report Generator. Thus, the completed version is "live" and available for use by the public for completing compliance documentation for posting or making available to enforcement agencies. When an issue or error that requires a revision is found in the production

version of the Report Generator, the urgency can be extreme since it may prevent the forward progress or approval of building projects in California.

Determining the appropriate course of action in response to a request for an urgent revision to the production version of the Report Generator must take into account the schema versioning considerations described in section 2.5.4. When the severity of the error is major, a patch may be warranted to resolve the urgent issue. A patch could be an immediate repair that is only a temporary solution, or may only partially resolve a problem. Patches to the production version must be backward compatible.

Patches should be implemented only when approved by the Energy Commission project manager. Patches may take the form of informal or temporary changes made by Data Registries to their user interfaces or to their document registration procedures; or the patch may be a change to the production version of the Report Generator software made by Energy Commission staff or technical contractors. After deployment of a patch, immediate follow-up actions by Energy Commission staff should document the details of the patch that was implemented, then the needed revision work that addresses the issue completely should be initiated according to the versioning procedures described in sections 2.3.1 through 2.3.4, and section 2.5.4.

2.3.5.4 Patches to Report Generator software

The following information should be compiled by the responsible Energy Commission project manager, and made available to technical consultants or staff when determining to make an emergency patch to the production version of the Report Generator software:

a. XML data file(s) that were sent to the Report Generator that triggered the problem that requires the patch. Alternatively, provide the date/time of the error in order to enable referencing the XML in the Report Generator log.

b. A written description of the problem.

c. If applicable, a written description of the proposed fix submitted by the person requesting the patch (e.g. a solution may have been proposed by a Data Registry technical person, or by the Energy Commission's responsible technical contractor or staff).

d. Written direction from the responsible Energy Commission project manager directing the technical contractor or staff to proceed with the patch.

Patches to the production version of the Report Generator software must be backward compatible. If the resolution requires a revision that is not backward compatible, the Report Generator software must be revised according to the versioning procedures described in sections 2.3.1

through 2.3.4, and section 2.5.4. If another versioning procedure is in progress, refer to sections 2.3.5.1 or 2.3.5.2 for further direction.

2.3.5.5 Patches to Data Registry Software

When a temporary patch to a Data Registry's user interface or document registration software can be utilized to fix severe problems associated with the production version of the Report Generator software, the following information should be compiled by the Energy Commission project manager, and made available to the applicable Data Registry technical staff, the Energy Commission technical consultants, and Energy Commission staff:

a. XML data file(s) that were sent to the Report Generator that triggered the problem that requires the patch. Alternatively, provide the date/time of the error in order to enable referencing the XML in the Report Generator log.

b. A written description of the problem.

c. If applicable, a written description of the proposed fix submitted by persons requesting the patch (e.g. a solution may have been proposed by a Data Registry technical person, or by the Energy Commission responsible technical contractor or staff).

d. Written direction from the responsible Energy Commission project manager directing Data Registry staff to proceed with the patch.

Patches to Data Registry software that uses the production version of the Report Generator software must be backward compatible. If the issue resolution requires a revision that is not backward compatible, the Report Generator software must be revised according to the versioning procedures described in sections 2.3.1 through 2.3.4, and section 2.5.4. If another versioning procedure is in progress, refer to sections 2.3.5.1 or 2.3.5.2 for further direction.

2.4 Compliance Document Design Files (Appendix A)

Appendix A contains a listing of the compliance document design files utilized for 2016 Title 24, Part 6 residential compliance document development. The Energy Commission project manager may grant access privileges for Data Registry Providers, Energy Commission staff, and technical contractors to view the current versions of each file in the relevant SVN file repository hosted at Unfuddle.com at the following URL:

https://cecbees.unfuddle.com/svn/cecbees_cecrescompliancedocdesignstwentysixteen/

The compliance document design files contained in Appendix A specify the basic requirements for the document data content and the graphical representations of the data reported on the document.

These basic requirements guide the creation of the compliance document schemas and XSL files utilized by the RG. The information contained in each of the compliance document design files is organized into three sections/categories which are described in section 2.4.1, section 2.4.2, and section 2.4.3. An example of the contents of a compliance document design file is given at the end of Appendix A.

2.4.1 Graphical Layout

The first section in the compliance document design file is the graphical layout section which describes the graphical representations for the sections contained in the completed compliance document, but without any representation of user-specific data that would otherwise be required to be shown in the data fields on a completed document. This graphical layout, along with the user instructions described below in Section 2.4.2, is published (for information only) on the Energy Commission website in conjunction with the publishing of the *Residential Compliance Manual*.

2.4.2 User Instructions

The second section in the compliance document design file is the user instructions section, which is provided in order to educate users of the Data Registries and to facilitate data collection by users in the field. The instructions are organized according to the section and field numberings used in the relevant sections of the graphical layout described in Section 2.4.1.

2.4.3 Data Field Definitions and Calculations (Pseudocode)

The third section in the compliance document design file is the Data Field Definitions and Calculations (pseudocode) section. Specification for allowable values for data fields, and specification for calculations and rules for allowable data responses are shown in data fields to provide guidance for creation of XML Schemas and XSL templates required for RG functionality.

2.4.4 Versioning

The latest version of a compliance document design file (MS Word docx format) is maintained by the Energy Commission Standards development staff. RG software functional issues that require resolution, and the revisions implemented to resolve the issues are tracked by Energy Commission staff. When new RG Doc version revisions are completed, and the new RG Docs version is posted to the RG test site, the new versions of the compliance document design files are committed to the SVN repository for reference by Data Registry technical staff. The Energy Commission project manager may grant access to view the contents of the SVN file repository to persons other than Data Registry Provider staff to enable relevant activities such as Standards stakeholder education materials preparation, and Standards update reviews. If needed, previous versions of a compliance document design file can be recalled for viewing using the SVN repository's version control functionality.

2.5 Compliance Document XML Schemas (XSD) (Appendix B)

Appendix B contains a listing of the XML Schema files utilized for the 2016 Title 24, Part 6, residential compliance document development. The Energy Commission project manager may grant access privileges for Data Registry Providers, Energy Commission staff, and technical contractors to view the current versions of each file in the relevant SVN file repository hosted at Unfuddle.com at the following URL:

https://cecbees.unfuddle.com/svn/cecbees_cecrgtestingtwentysixteen/

The schema files provide the basis for determining whether data submitted to the RG for production of Adobe Acrobat Portable Document Format (PDF) compliance documents are valid. Data Registries are expected to configure their user interfaces to receive valid data from authorized users of the Registry. Data Registries are expected to perform a validation check of the document data prior to sending a call to the RG for a PDF report for the document. The RG database contains a copy of the current version of the schema for each compliance document and uses the current schema file to check for valid data as a prerequisite to processing requests from Data Registries for a completed PDF report.

Version control is an essential means of recording the state of a software source code at different times during its development and revision phases. It allows for rolling back to previous versions when needed. For example if a defect is discovered in XML schemas that have been released, it is desirable to be able to return to a previous version that doesn't have the defect. Because the XML schemas are code generated originally from Microsoft SharePoint (a team collaboration software tool) schema lists with the use of schema workbooks and macro code, version control needs to be applied to the SharePoint schema lists and the source code used to generate the schemas. Section 2.5 describes the inputs, intermediary products, final XML schema files, and how versioning is applied to them.

2.5.1 SharePoint Schema Lists

2.5.1.1 Purpose

The SharePoint schema lists are the original and only source of data for generated XML schemas required for creation of registered compliance documents. All entries are made in the SharePoint schema lists that contain columns for defining the terms and all required XML schema parameters, and columns for linking terms to other terms in the Standards Data Dictionary (SDD). The SharePoint schema lists are exported to special schema generation excel workbooks and macro code is run to generate the XML schemas using these workbooks.

2.5.1.2 Versioning

Any version of a SharePoint schema list can be saved as a template with content. Then if there is a need to roll back to a previous version, the SharePoint schema list for that version can be regenerated from the template.

2.5.2 Schema Generation Microsoft Excel Workbooks and Macros

2.5.2.1 Purpose

The schema generation workbooks and macros are used to generate all of the required XML schemas from the SharePoint lists. The workbooks are loaded with latest SharePoint schema lists, then one macro is run to generate the SDD base schema set, and another macro is run to generate compliance document schemas.

2.5.2.2 Versioning

When a major or minor version of the library of schemas is released, the processed schema generation workbooks and the version of the collection of macros used to generate the schemas should be bundled in a Zip file and committed to the 2016 Report Generator - Res Source SVN repository in a folder called SchemaGenerationSource.

2.5.3 XML Schemas for SDD Base Set and Compliance Document Schemas

2.5.3.1 Purpose

The SDD base schemas and compliance document schemas provide data specification for the XML files required when a compliance document is registered. The XML schemas are then used to validate XML files sent to the RG and sent to the Energy Commission Document Repository. Note: The Energy Commission has not yet developed the document repository. Validation of XML files at the document repository will not be required until the Energy Commission develops and approves the document repository.

2.5.3.2 XML Schema Version Attribute

Every SDD base set schema and compliance document schema has a version attribute which contains a major version number followed by a period separator followed by a three digit minor version number followed by “SDD” appended.

2.5.3.3 Schema Generation Code Version

Every schema also records the version of the ddtools macro used to generate the schema. This is found at the top of the schema in the last documentation element before any element or type definitions. Ddtools### is the filename which appends three digits for the incremental version

number. It is a set of software macros which includes those macros used to generate the residential SDD base schema and the compliance document schemas.

2.5.3.4 Schema Versioning Procedures

When the schemas are generated from the workbooks using ddtools macros, the version attribute is loaded with the schema version stored in the model workbook and the ddtools version is recorded in the documentation element.

Every compliance document schema also has in the payload element an attribute called ComplianceDocumentSchemaVersion. When a compliance document XML file is sent to the Report Generator, it is validated against the latest released version of the schemas. When validation is complete the RG stores the schema version used to validate the XML in the ComplianceDocumentSchemaVersion attribute.

2.5.3.5 SVN Version Control

The schemas are stored in SVN source code control. If needed, previous versions of an XML schema can be recovered using SVN version control functionality. However, if the purpose is to roll back to a previous version and then begin further revisions, this should be done using version control as described in section 2.5.1 SharePoint Schema Lists.

2.5.4 Policies for Major and Minor Versioning

2.5.4.1 Major Versioning Policy

Assuming there are changes that need to be incorporated into the schemas more frequently than the Title 24, Part 6, Standards three year update cycle, major version releases may occur on a regular schedule such as once a year. The Energy Commission staff will determine the schedule and inform stakeholders when versions are scheduled for release.

2.5.4.2 Backward Compatible Minor Version Policy

Revisions that are backward compatible generate a minor version release and can be made at any time as they provide an improvement without disrupting existing processing. Versions containing only backward compatible changes are assigned the next minor version number e.g., if current version is V1.000 the next minor release would be assigned V1.001.

2.5.4.3 Examples of Backward Compatible Changes to Existing Schemas

a. Adding optional elements to a complex type.

b. Adding one or more new enumeration constants to a type.

c. Changing a numeric type from one decimal place to two decimal places.

d. Any changes to documentation tags such as appinfo display term will always be backward compatible because the schema parsers do not look at documentation tags.

2.5.4.4 Use Case: Backward Compatible Minor Version Release

a. Official versions of all schemas are released with schema version number V1.000.

b. Data Registry Providers implement changes to support generating XML files compliant with V1.000.

c. Two months later, Data Registry "Provider A" requests one of the following changes:

- Extend an enumeration with an additional value for a particular compliance document.
- Add an optional element to a type definition for a particular compliance document.
- Change decimal type to increase the number of decimal places.

d. Revision is approved because it is backward compatible and released as version V1.001.

e. Provider A implements V1.001 changes and submits a valid XML file that includes the change to the Report Generator, which validates against V1.001. The Report Generator then loads "V1.001" into the Payload attribute ComplianceDocumentSchemaVersion.

f. Provider B does not implement the change because they do not need to exercise the change in V1.001. They submit an XML to the Report Generator which also validates against V1.001 and the Report Generator loads V1.001 into the Payload attribute ComplianceDocumentSchemaVersion.

2.5.4.5 Non-Backward Compatible Major Version Policy

Non-backward compatible changes are disruptive because they break the previous version of the schema. Therefore requests for revisions that are not backward compatible are evaluated before they can be approved.

2.5.4.6 Issue Severity of Non-backward Compatible Changes

Non-backward compatible change issue severity is based on how serious the problem is that will be corrected with the change. Issue severity ranges from minor non-data changes such as improved naming or correcting spelling to correction of major errors in data correctness or completeness. The more severe the data integrity problem that will be fixed with the change, the more likely it will be approved by the Energy Commission project manager.

2.5.4.7 Disruptiveness of the Non-backward Compatible Change

Non-backward compatible change disruptiveness is based on the number of compliance document schemas that are affected and how frequently they are used. Changes that affect fewer compliance document schemas are more likely to be approved by the Energy Commission project manager.

If evaluation finds the request for a non-backward compatible change to be trivial or too disruptive, it will be added to the list of changes for the next regular major release.

When evaluation finds the request for a non-backward compatible change has a high issue severity score and/or a very low disruptiveness score, the final approval of the non-backward compatible change requires input from representatives of all stakeholders using the schemas. If, after reviewing the stakeholder input, the Energy Commission project manager approves the change, it will be implemented and a major version will be released sooner than the next regularly scheduled major version release according to a schedule determined by the Energy Commission project manager.

Versions containing any non-backward compatible changes are released as the next major version; e.g., If the current version is V1.251 the next major release would be V2.000.

2.5.4.8 Examples of Non-backward Compatible Changes

a. Changing a numeric type from decimal to integer. Previous XML with numbers that use decimals will fail validation.
b. Renaming a type. Previous XML with previous name will fail validation.
c. Adding a new required element in a type. Previous XML won't have the new required element and will fail validation.
d. Removing or changing an existing enumeration value. Previous XML with removed or old spelling will fail validation.
e. Removal of required elements from a schema. Previous XML with the removed element will fail validation.

2.5.4.9 Use Case: Non-Backward Compatible Major Version Release

a. Official versions of all schemas are released with schema version number V1.000.
b. Data Registry Providers implement changes to support generating XML files compliant with V1.000.
c. Two months later, a request for one of the following non-backward compatible changes is made:
    - Remove or rename an enumeration value.
    - Add a required element to a type definition.
    - Remove a required element.
    - Change a decimal type to an integer.

d. The Energy Commission project manager must evaluate the requested change for issue severity and disruptiveness because it is a non-backward compatible change. One of the following actions will be taken depending on the evaluation:

   - Add changes to next regularly scheduled major version release for changes with low severity/highly disruptive combination that does not require immediate attention.
   - Energy commission project manager reviews input from stakeholders and approves a special major version release if the change is a combination of high severity/low disruptiveness that requires immediate attention.
   - Implement non-backward compatible changes planned for the next major version release and assign the next major version number, V2.000.

e. Providers who process the schemas that are changed in this major release implement the changes. Their Data Registry sends a valid XML file that includes changes in this version to the Report Generator which validates against the new version,V2.000. The Report Generator then loads "V2.000" into the Payload attribute ComplianceDocumentSchemaVersion.

   - For changes that only affect compliance document schemas and not base schemas, any Data Registry Provider that does not process the modified compliance documents does not have to implement the changes in the new version, V2.000. They submit XMLs for other schemas to the Report Generator and the XML files validate successfully against the new version, V2.000 and the Report Generator loads the new version, V2.000 into the Payload attribute ComplianceDocumentSchemaVersion.

2.6 Compliance Document XSL Templates

Two complimentary XML technologies are used in the Energy Commission Report Generator software for producing the required PDF format compliance documents: Extensible Stylesheet Language Transformation (XSLT) and Extensible Stylesheet Language Formatting Objects (XSL-FO). These technologies are used in XSL templates created for each of the compliance documents that work directly with the XML data contained in the document registration packages received from the Data Registries to transform the XML data into the required PDF format reports used for creating registered compliance documents.

XSL templates also draw upon the information contained in the schema (XSD) files when generating the PDF format reports. Thus design of the XSL templates must be coordinated with the design of the XSD files. And when revisions are needed to a compliance document, the revisions must be incorporated into both the XSD and the XSL files.

XSL Templates are not used by Data Registries, thus a listing of the library of XSL template files has not been included in this *Data Registry Requirements Manual.* A listing of the XSL template files is included with the technical documentation for the Energy Commission Report Generator software. A repository containing the XSL template files is available for use by authorized Energy Commission staff and technical consultants in charge of the Report Generator software development and maintenance.

3 Document Registration Processes

3.1 Overview

Registration is the process applicable to the California Title 24, Part 6, electronic compliance documents that are verified as complete by the Data Registry, and are electronically signed by all required Data Registry authorized users. Registration is initiated when an authorized registration signer signs the compliance document electronically. Subsequently the Data Registry adds the registration signer's electronic signature to the signature block, appends a unique registration number to each page of the document, applies the Data Registry Provider's digital certificate issued by a certificate authority approved by the California Secretary of State, and displays the Data Registry Provider's digital signature on the compliance document. Subject to implementation of a central electronic document repository by the Energy Commission, when registration is complete, the Data Registry immediately and automatically transmits a copy of the completed registered compliance document to the Energy Commission Compliance Document Repository and retains a copy of the registered compliance document for use by authorized users for submittals.

A registered document is a compliance document that has been submitted to a Residential or Nonresidential Data Registry for retention, verified as complete, and has gone through the registration process so that the registered document displays all applicable electronic signatures as well as the Provider's digital certificate and the document's unique registration number. The image of the registered document is accessible for printing or viewing by authorized users of the Registry via the Registration Provider's Internet website. The registered document's unique visible registration number is appended onto the document image by the Data Registry.

3.2 Data Validation Requirements for Data Registries

Data validation rules are specified by the XML schema for the compliance document. Refer to Appendix B for listings of the XML schema files for each of the Title 24, Part 6, compliance documents. Validation criteria include but are not limited to specifications for:

- The required data type.
- Whether data is required or optional.
- Data numeric upper and lower bounds.
- Acceptable enumeration values.
- Calculations that must be performed.

Data Registries are expected to configure their user interfaces to receive valid data from authorized users of the Registry. Registries are expected to perform a validation check of the document data prior to sending a call to the RG for a PDF report for the document. The RG Database contains a copy of the current version of the schema for each compliance document and checks for valid data as prerequisite to processing a PDF report.

3.3 Document Registration Prerequisite Rules

Completion of the registration process for certain compliance documents is expected to be contingent upon satisfying prerequisite rules that are in addition to the basic data validation requirements and authorized user signature requirements specified in *Reference Joint Appendix JA7*. Additional descriptions, guidance, and examples for use of these prerequisite rules follow.

3.3.1 Document Configuration Rules

Document configuration rules are presented in Section 6.3. A listing of the document configuration rules applicable to specific compliance document types and HERS verification features is presented in Table 6.2.

Example: For the performance compliance approach for existing buildings, improvements to existing conditions are given credit when the existing condition is verified by a HERS Rater and documented on a CF3R-EXC-20. When an applicant claims credit for improvement to an existing condition on the CF1R-PRF, the Data Registry is expected to prevent registration of the CF1R-PRF until a CF3R-EXC-20 has been registered that confirms the existing conditions verified in the field are the same as the existing conditions modeled by the compliance software and reported on the CF1R-PRF.

From Table 6-1. Document Configurations Rules:

Document Number	Document Type	Document Description	Document Configuration Rules
CF3R-EXC-20-H	Certificate of Verification	HERS Verification for Existing Conditions for performance compliance for alterations. Required as prerequisite to registration of a CF1R-PRF for an altered dwelling.	When credit for existing conditions is used on the CF1R, as condition for CF1R registration, an EXC-20 that verifies the existing condition claimed on the CF1R shall first be registered.

3.3.2 Data Field Definition Rules

Document registration prerequisite rules may be embedded in the data field definition rules for a certain field contained in a compliance document as detailed in the pseudocode in the Data Field Definitions and Calculations section of the compliance document design files in Appendix A. For example, fields for which the results are calculated utilizing data referenced from another compliance document cannot be completed until the other source/referenced compliance document has been completed and registered. Alternatively, the rule may require, as a prerequisite to allowing registration, that another compliance document is registered indicating compliance with a certain Standards requirement.

Example: For compliance with the refrigerant charge verification requirements in Standards Sections 150.1(c)7A, and 150.2(b)1F, verification of minimum space conditioning system airflow rate according to the field verification and diagnostic testing protocols in Reference Residential Appendix RA3 is required; otherwise a verified return duct design according to Standards Tables 150.0-B or C is required. The choice of use of airflow rate verification (MCH-23) or return duct design verification (MCH-28) for compliance is made at the installation phase by the installer. Thus for the procedure for registering a CF2R-MCH-25b compliance document (refrigerant charge verification using the subcooling procedure), the Data Registry must require registration of a CF2R-MCH-01 that indicates which method of compliance was chosen by the installer for airflow rate compliance (MCH-28 or MCH-23) and also must require registration of the applicable CF2R-MCH-23 or CF2R-MCH-28 as prerequisite to allowing the CF2R-MCH-25b to be registered.

From data field E02 on the 2016-CF2R-MCH-25b:

02	System Airflow Rate Verification Status	<<if the CF2R-MCH-01 indicates a MCH-28 is required for alternative minimum airflow rate compliance, then: if the system has a registered CF2R-MCH-28 that indicates compliance with Table 150.0-B or C return duct design requirements, then result = **system complies using Table 150.0-B or C alternative return duct design criteria**. else result = **System does not comply. A registered CF2R-MCH-28 is required** (do not allow this MCH-25 to be registered). elseif the CF2R-MCH-01 indicates a MCH-23 is required for minimum airflow rate compliance, then if this system has a registered CF2R-MCH-23a or CF2R-MCH-23b that meets the compliance criterion in E01, then result = **System complies with minimum airflow rate requirements**; elseif A09 = Alteration, then, if the system complies with the alternative airflow compliance method on a registered CF2R-MCH23c; then result = **system complies using the alternative remedial actions specified in RA3.2.2.7.3**. **This System does not qualify for Group Sampling.** else result **System does not comply. A registered CF2R-MCH-23 for this system is required** . (do not allow this MCH-25 to be registered). end>>

3.3.3 Data Security and Authentication Rules for the Performance Certificate of Compliance Transmission Package

A Data Registry is expected to implement data security and authentication for processing of the Performance Certificate of Compliance Transmission Package (transmission package) data exchange between the Compliance Software, Report Generator, and the Data Registries as described further in Sections 5.5 and 5.6. These data must traverse an unknown chain of custody after being processed by the Report Generator. Thus a submission to a Data Registry will be a persisted data file that possibly could be tampered with, but XML digital signing at the Report Generator would make any such tampering known to the Data Registry. The Report Generator embeds a PDF-formatted Certificate of Compliance document into a Transmission Package as Base-64 ASCII data. When a Transmission Package contains encoded PDF data that conform to the prerequisite requirements for document registration by a Data Registry (described further below) the transmission package will contain an XML digital signature, otherwise the package will **not** contain an XML digital signature.

To ensure the authenticity of a transmission package, the Data Registries are expected to incorporate processes into the Performance Certificate of Compliance document registration procedure that can verify the XML digital signature of each electronic submission.

The Data Registries must implement a procedure to verify that a valid XML digital signature is attached to the CBECC data and the Certificate of Compliance document PDF image contained in the completed Transmission Package to ensure there was no alteration after it was produced by the Report Generator. Such verification should be performed as prerequisite to allowing a transmission package to be uploaded to the Data Registry or used for the Certificate of Compliance document registration.

The Report Generator uses Public Key Infrastructure (PKI) to sign the transmission package and includes the XML digital signature and as a <Signature> element in the XML data. Any alteration to either the CBECC data or the Certificate of Compliance document PDF image, such as inserting a different encoded PDF, would invalidate the original signature. This signature can be verified using the Public Key available from the Report Generator (see Section 5.6 for additional details).

Note: The Report Generator response XML will only apply signing when a CBECC Compliance Software submission has completed all the checks during processing and generates a non-watermarked PDF. If the Report Generator processing does not complete normally, there will be NO signature element in the transmission package.

3.4 Residential Registration Numbering Conventions

The registration numbering conventions described in this section supersede the residential registration numbering convention specified in *2016 Reference Joint Appendix JA7.5.4.2.* These updated numbering conventions have added digits to designate building number, dwelling unit number, document type, and clarify the registration numbering for CF1R worksheet documents.

The registration numbers assigned to 2016 residential compliance documents by the Data Registry at the conclusion of the registration process should conform to the conventions described in this section.

3.4.1 Document Type Designators

The document type designators for use in registration numbers are given in the first column of Table 3-1.

Table 3-1. Category Designators for Use with Registration Numbers

Category Designator for Registration Numbers	Compliance Category	Description	Compliance Document Type Applicability
P	PRF	Performance	CF1R
N	NCB	Prescriptive Newly Constructed Buildings	CF1R
D	ADD	Prescriptive Additions	CF1R
A	ALT	Prescriptive Alterations	CF1R
E	ENV	Envelope	CF1R Worksheet, CF2R, CF3R
R	SRA	Solar Ready Area	CF1R Worksheet
V	SPV	Solar Photovoltaic	CF2R, CF3R
T	STH	Solar Thermal Heating	CF1R Worksheet, CF2R
M	MCH	Mechanical	CF2R, CF3R, NRCV
B	PLB	Plumbing	CF1R Worksheet, CF2R, CF3R, NRCV
X	EXC	Existing Conditions	CF3R
L	LTG	Lighting	CF2R
Z	-	Nonresidential Newly Constructed	NRCV
Y	-	Nonresidential Alterations to Existing	NRCV

3.4.2 Numbering Convention for CF1R, CF2R, CF3R, and NRCV Documents

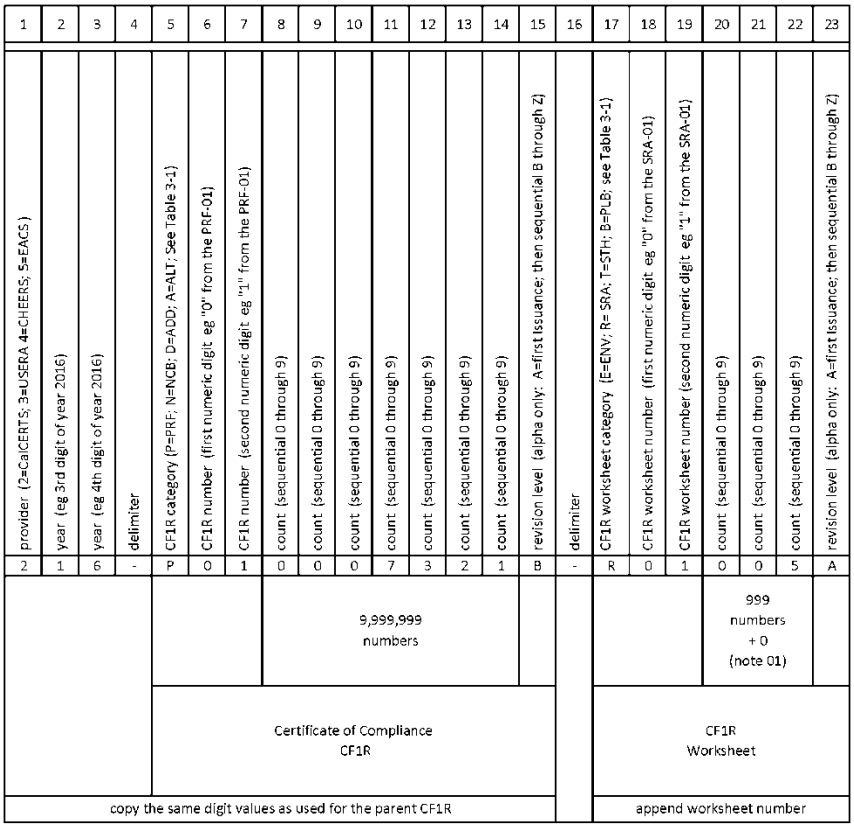
Figure 3-1 presents the organization for the numbering convention for CF1R Worksheets. Figure 3-2 presents the organization for the numbering convention for CF1R, CF2R, CF3R, and NRCV compliance documents. An example number is also demonstrated in Figures 3-1 and 3-2.

For volume-builder subdivision/neighborhood projects, when a CF1R for a model plan is registered with a Data Registry, then submitted to an enforcement agency for plan check and approval, the approved CF1R is generally not required to go through plan check every time that model plan is used to build a home in the subdivision. The same building design plan and Certificate of Compliance approved by the enforcement agency may be used for each build-out of that approved plan as long as the building design plans are not revised. The Certificate of Compliance registration number for the approved plan uses a unique number and revision identifier for this "parent" CF1R. This parent CF1R is subsequently referenced by the many site-specific Certificate of Installation (CF2R) and Certificate of Verification (CF3R) "children" documents. A similar "one parent" to "many children" document configuration is used for multifamily buildings. For this use case, the CF1R may be created using the whole-building compliance approach, thus the documentation for each dwelling unit in the multifamily building will consist of one copy of the "parent" CF1R and also the applicable dwelling unit-specific CF2R and CF3R "children" compliance documents required for each individual dwelling unit.

CF1R worksheets are documents that provide supplemental information needed to complete the Certificate of Compliance. For instance, an ENV-04 determines the Cool Roof information that is subsequently entered on the CF1R to complete it. Thus conceptually, these worksheets should be considered to be additional CF1R document pages and could use the same registration number as the approved CF1R document, regardless of whether the CF1R is a performance or prescriptive document type.

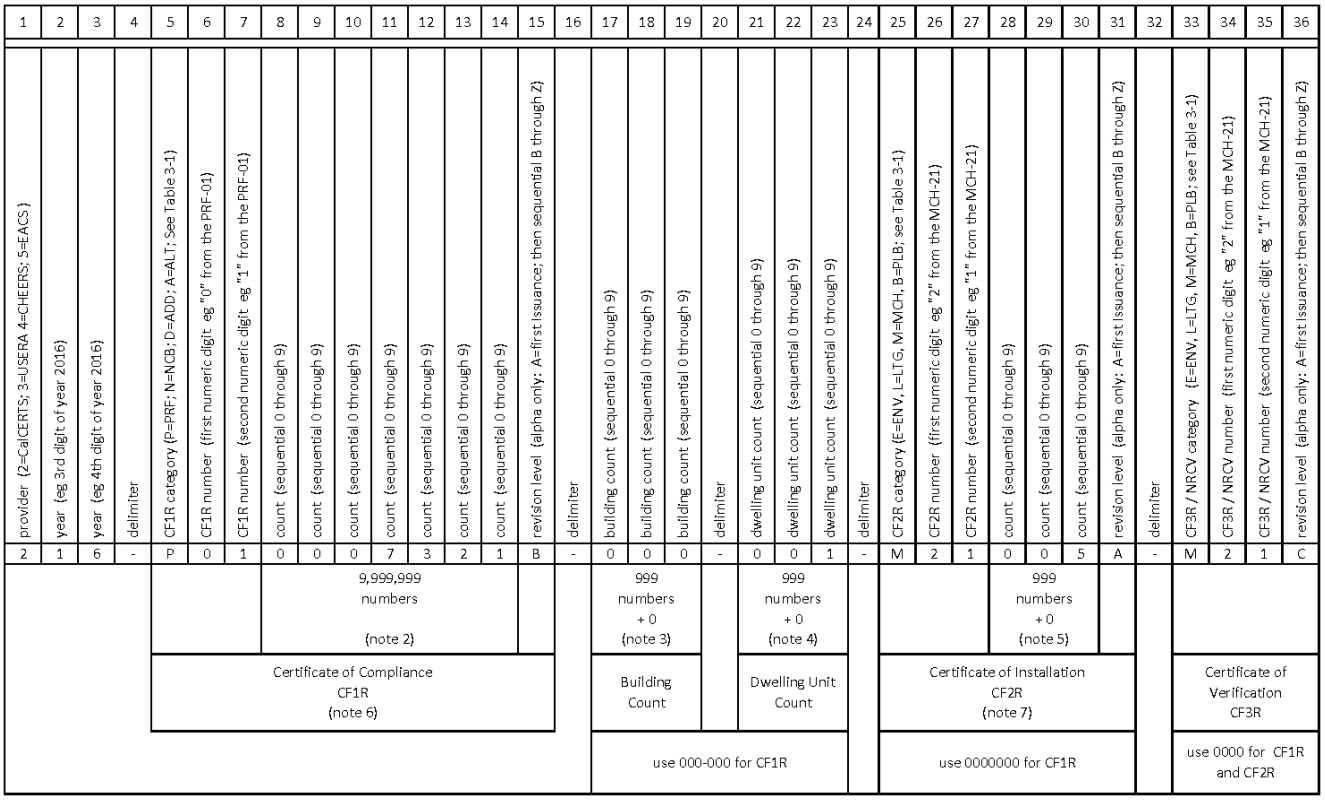
The registration numbering convention for the CF1R worksheets uses the same first 16 digits that are used in the parent CF1R registration number convention (includes 2 delimiters). Additionally, for the worksheet documents the convention appends digits that describe each specific worksheet. There are no digits for CF2R or CF3R documents represented in a worksheet document registration number. Since the first 16 digits of the registration number will be the same on CF1R worksheet documents as are used in the numbering convention for registering the CF2R and CF3R documents, one unique "parent" CF1R revision level and registration number will be common to all documents for the approved plan.

Figure 3-1. Numbering Convention for CF1R Worksheets



The registration numbering convention for the CF1R, CF2R, CF3R sequence has been modified from the 2013 version to insert six additional registration number digits that describe the building and dwelling unit: three digits for the building, and three digits for the dwelling unit. Refer to the numbering convention in Figure 3-2 below and the corresponding notes and example numbers that follow for additional numbering convention details.

Figure 3-2. Numbering Convention for CF1R, CF2R, CF3R, and NRCV Documents



Use only capitalized alpha digits; Omit use of the letter "O" to avoid confusion with the number Zero "0"; Omit use of the letter "I" to avoid confusion with the number One "1".

Note 1 (Figure 3-1): - CF1R worksheet count

- Reset to 001 for the first worksheet created for a new CF1R.
- Increment sequentially by 1 for each additional worksheet created for the CF1R.

Note 2 (Figure 3-2) - CF1R count:

- Reset to 0000001 for the first new CF1R registered beginning on January 01 of each calendar year.
- Increment sequentially by 1 for each additional new CF1R registered during the calendar year.

Note 3 (Figure 3-2) - building count:

- Reset to 000 when the CF1R number increments (i.e. reset to 000 for a building that uses a new CF1R number).
- For single family dwellings (buildings), use 000 for all dwelling units that use the CF1R.
- For multifamily buildings, use 001 for the first multifamily building that uses the CF1R, and increment sequentially by 1 for each additional multifamily building that uses the CF1R.
- For nonresidential buildings (NRCV document type):
    - Reset to 000 when the "CF1R" number increments (i.e. reset to 000 for a nonresidential project that uses a new "CF1R" number).
    - use 001 for the first building in the project, and increment sequentially by 1 for each additional building in the project that uses the "CF1R" number.

Note 4 (Figure 3-2) - dwelling unit count:

- Reset to 000 when the CF1R number increments (i.e. reset to 000 for a building that uses a new CF1R number).
- Reset to 000 when the building count increments (i.e. reset to 000 for each additional Multifamily building that uses the same CF1R).
- For single family dwellings use 001 for first dwelling unit, and increment sequentially by 1 for each additional single family dwelling that uses the CF1R.
- For multifamily buildings, use 001 for the first dwelling unit in the building, and increment sequentially by 1 for each additional dwelling in the building that uses the CF1R.
- For nonresidential buildings (NRCV document type),
    - Reset to 000 when the "CF1R" number increments (i.e. reset to 000 for a nonresidential project that uses a new "CF1R" number)
    - Reset to 000 when the building count increments (i.e. reset to 000 for each additional nonresidential building that uses the same "CF1R" number)
    - Use 001 for the first tenant unit in the building, and increment sequentially by 1 for each additional tenant unit in the building that uses the "CF1R" number.

Note 5 (Figure 3-2) - CF2R count:

- Reset to 000 when the CF1R number increments (i.e. reset to 000 for a building that uses a new CF1R number).
- Reset to 000 when the dwelling unit count increments (i.e. reset to 000 for a new dwelling unit in the building).
- Use 001 for the first CF2R in a dwelling unit, and increment sequentially by 1 for each additional CF2R in the dwelling unit.
- For nonresidential buildings (NRCV document type),
    - Reset to 000 when the tenant unit count increments (i.e. reset to 000 for a new tenant unit in the building).
    - Use 001 for the first system in the tenant unit, and increment sequentially by 1 for each additional system in the tenant unit.

Note 6 (Figure 3-2) - "CF1R" numbering for nonresidential building projects (NRCV document type):

- For newly constructed buildings, digits 5-6-7 = Z00.
- For alterations to existing buildings, digits 5-6-7=Y00.
- For all NRCV documents, digit 15=0.

Note 7 (Figure 3-2) - "CF2R" numbering for nonresidential building projects (NRCV document type):

- For all NRCV documents, digits 25-26-27=0.
- For all NRCV documents, digit 31=0.

The following provides example registration numbers and the interpretation of the significance of the digits used in the numbers as consistent with the conventions given in Table 3-1, Figure 3-1, Figure 3-2 and notes 1 through 7 above.

216-P010007321B-000-000-0000000-0000:

- Parent CF1R document
- CalCERTS Provider
- Year 2016
- Performance CF1R document (PRF-01)
- sequential number 7321,
- revision B

216-P010007321B-R01005A:

- CF1R worksheet document
- SRA-01 document associated with the parent CF1R document above
- Sequential number 005
- Revision A

216-P010007321B-000-001-M21005A-0000:

- CF2R document associated with the parent CF1R above
- Single family dwelling unit
- Dwelling unit number 1 for this CF1R parent
- CF2R-MCH-21 document
- CF2R sequential number 005 contained in dwelling unit 1
- Revision A

216-P010007321B-000-001-M21005A-M21C:

- CF3R document type associated with the CF2R document above
- MCH-21 document type
- Revision C

216-Z0000073220-002-004-0000020-M20B:

- CalCERTS Provider
- Year 2016
- Nonresidential building (NRCV document type)
- Newly constructed building
- "CF1R" sequential number 7322 for this project
- Building number 2 in project 7322
- Tenant unit number 4 in building number 2
- System number 2 in tenant unit number 4
- MCH-20 document
- Revision B

4 Electronic Signatures

4.1 Overview

Reference Joint Appendix JA7.6 describes the distinction between electronic and digital signature requirements. Digital signatures and digital certificate authorities are further described in Section 5 below. From Section JA7.2 definitions: electronic signature is a "computer data compilation of any symbol or series of symbols executed, adopted, or authorized by an individual to be the legally binding equivalent of the individual's handwritten signature." US 21 Code of Federal Regulations (CFR) Section 11.3. The electronic signature process for Title 24, Part 6, compliance documents is described in *Reference Joint Appendix JA7.6.3.2.1* (Electronic Signature Capability) and *JA7.6.3.2.3* (Signer Review and Signature Actions). Additional guidance for use of electronic signatures for registering Title 24, Part 6 compliance documents follows.

4.2 Establishing a User Account and Signature Authority

Anyone who wishes to sign Title 24, Part 6 compliance documents electronically using a HERS Provider Data Registry will be required to establish a user account with a Data Registry secured by a unique user name and password. Creating a user account requires the applicant to provide sufficient information to establish their identity with the Registry. Users who wish to sign compliance documents electronically must provide, at a minimum, the data that would have to be entered into each of the fields on the signature block for the compliance document. To be granted signature authority for certain document types, the applicant must also provide proof of possession of all requisite professional qualifications applicable to the scope contained on the compliance document to be signed. For example, if an HVAC contractor wants to register refrigerant charge verification documents, the HVAC contractor's C-20 license number would be required to be disclosed to the Data Registry, and this license number will be reported in the signature block when the contractor signs the document as the responsible person. The applicant may also provide a wet signature on the user account application that will be scanned electronically. The scanned image of the wet signature will be overlaid on the completed electronic compliance document in the signature field after the user activates an electronic signature for the document.

Once the user has established a user name and password to access a personal account with a Data Registry, signing actions will be attributed to the user account as identified by the account's unique user name and password.

When an authorized user elects to sign a document, a signing action should be required, such as clicking on a control (e.g. button or check box icon etc.) in the Data Registry user interface which then results in the Data Registry populating the signature block with the user's professional information, and an image of the wet signature.

Separate user accounts must be established with each Data Registry when more than one Data Registry is utilized by a user for registration of compliance documents.

4.3 Data Field Definitions for Signature Blocks

4.3.1 Electronic Images and Fonts Used for Electronic Signatures

Reference Joint Appendix JA7.6.3.2.1.3 requires authorized users to provide an electronic image of their handwritten signature to the Data Registry for use in displaying their electronic signature. At a minimum the Data Registry must make available functionality for use of an electronic (scanned) image of the user's wet signature. Other methods are allowed to be used if the Data Registry user interface provides the alternative signature creation functionality. Such alternative methods may allow use of a mouse or other pointing device to draw an electronic signature, or the Data Registry may elect to make available the option for a user to select a font representation of their handwritten signature.

4.3.2 Signature Block Data Validation

Data fields in signature blocks are not required to have values assigned to them when submitting XML to the Report Generator for publishing a PDF compliance document. However, including data values in signature block fields in the XML is allowable. Therefore, if values are assigned to the signature block data fields in the XML transmitted to the RG, the data must be valid in accordance with the schema for that signature block, otherwise the XML for that compliance document submitted to the Report Generator will fail validation.

4.3.3 Appending the Signature Block Data

The requirements for a Data Registry Provider to verify the unique professional information submitted by a user when applying for a signature authority is specified in JA7.6.3.2.1.2; additional guidance is described in Section 4.2. Populating the signature block with a user's unique professional information is described in JA7.6.3.2.3; additional guidance for appending the signature block data is given in Sections 4.4 and 4.5.

4.4 Electronic Signature Process Flow

The process for electronically signing a Title 24, Part 6, compliance document should include attention to the following guidance points for the process flow:

a. When data entry into the Data Registry user interface (UI) has been completed for a compliance document, and the Documentation Author wishes to sign the document, the Data Registry must first call for and receive from the RG a PDF file report (PDF printout) of the completed compliance document. This makes available to the signer the ability to review the completed document prior to signing. As a prerequisite to making signing controls available to the documentation author signer, the Registry transmits a call to the Report Generator that includes all required XML data to complete the document. The Report Generator validates that data against the schema for that document and returns a PDF to the Data Registry.

b. The Report Generator does not register the document. Registration procedures are conducted by the Data Registry by incorporating or appending signatures, registration numbers, date/time stamps, etc., to the completed and validated PDF received from the RG.

c. The signing actions of responsible persons, documentation authors, or field technicians are not required to occur at the same point in time or at the same time as the data input.

d. The identity of a responsible person signer is not required to be known to the documentation author.

e. As required by JA7.6.3.2.3.4 when an authorized user signs a document, the Registry must provide a display of the compliance document that allows the user to access any part of the compliance document information for review, including a display of the document declaration statement.

f. The documentation author must review the PDF file received from the Report Generator and then by performing a signing action, certify compliance with the declaration statements on the document.

g. When the documentation author signs the document, the Data Registry automatically appends the documentation author's signature block information into the document XML data portion of the transmission package received from the Report Generator, and overlays the documentation author's signature image, and the documentation author's signature block information onto the documentation author portion of the signature block in the PDF.

h. The Data Registry makes available to the responsible person the ability to view prior to signing, a copy of the completed PDF that was signed by the documentation author.

i. The responsible person must review the PDF file received from the Report Generator and then by signing, certify compliance with the declaration statements on the document.

j. When the responsible person (or authorized representative) signs the document, the Data Registry appends the responsible person's signature block information into the document XML data portion of the transmission package received from the Report Generator, and overlays the responsible person's signature image, and signature block information onto the responsible person's portion of the signature block in the PDF (see Section 4.5.2 for additional information on signatures given by authorized representatives of the responsible person on Certificates of Installation).

k. The responsible person's signing action should also trigger the digital signing (by the Data Registry) of the completed document PDF file and also the digital signing of the XML data as described in Section 5 to complete the registration process. The completed registered transmission package should be a single file containing an embedded digitally signed PDF document file and also digitally signed XML data.

This process flow for electronically signing compliance documents is recommended to avoid sending XML data to the report generator multiple times for each document to populate the signature block fields for each signing action.

Transporting bitmap or graphical images of signatures to and from the Report Generator is not supported. The user's signature image in the signature block on completed compliance documents is expected to be overlaid on the PDF document signature block by the Data Registry when the user provides the signing action during registration of the PDF document.

4.5 Delegated Signatures and Authorized Representatives

4.5.1 Delegation of Signature Authority for Certificates of Installation

Section RA 2.5 of the 2016 Reference Residential Appendices states:

- The builder or subcontractor who is eligible under Division 3 of the Business and Professions Code to take responsibility for the construction or installation, or their authorized representative, shall provide an electronic signature to register the Certificate of Installation, to certify the information provided on the Certificate is true and correct, and confirm that the construction or installation complies with the requirements shown on the dwelling unit Certificate of Compliance that was approved by the enforcement agency.

The phrase "builder or subcontractor" in this context means contractors and subcontractors, including contractors holding various license classifications such as Class C-20-Warm-Air Heating, Ventilating, and Air-Conditioning (Responsible Person).

Section 10-103(a)3 of the 2016 Standards states:

- **Delegation of Signature Authority.** Except where prohibited by law, including but not limited to any requirements under Division 3 of the Business and Professions Code, the

Responsible Person may delegate signature authority to third parties (*Authorized Representatives*) provided that there is a written agreement:

i. Between the *Responsible Person* and the person to be designated as the *Authorized Representative*.

ii. Specifying that the *Authorized Representative* may sign Certificates of Installation on behalf of the *Responsible Person*.

iii. Specifying that the legal responsibility for construction or installation in the applicable classification for the scope of work specified on the Certificate of Installation document(s) remains with the Responsible Person.

iv. That is signed by both the *Responsible Person* and the *Authorized Representative*.

v. That is retained by the HERS Provider to which all compliance documents are submitted for the building to which the Certificate of Installation documentation pertains.

vi. That is maintained in the HERS Provider Data Registry such that it is accessible for verification by, included but not limited to, the Energy Commission and enforcement agencies.

When the Standards require the Certificate of Installation to be registered, the responsible person must become an authorized user of the applicable Data Registry and must establish the applicable required signature authority with the Data Registry. Documentation meeting the requirements of Section 10-103(a)3 shown above in this subsection, that identifies the responsible person's designated authorized representative(s), must be submitted to the Data Registry Provider as prerequisite to granting authorized representatives signature authority. Authorized Representatives must also be authorized users of the Data Registry.

Data Registries must provide Energy Commission staff and enforcement agencies a user interface capability to generate reports that disclose the status of authorized representatives of responsible person users as required by Standards Section 10-103(a)3vi.

4.5.2 Signature Block Data for Delegated Signatures

When a responsible person's signing action on a Certificate of Installation is performed by an authorized representative of the responsible person, the information appended to the signature block XML data portion of the transmission package, and overlaid on the responsible person's signature block on the PDF (see Section 4.4 j) should be the responsible person's professional information – not the authorized representative's professional information. Additionally, the electronic signature appearance on the document should include a statement to the effect that the authorized representative's signature is provided on behalf of the responsible person.

The Data Registry should limit the availability of delegated signature functionality to only those users who have been designated as authorized representatives as described in Section 4.5.1.

5 Digital Signatures and Certificate Authorities

5.1 Overview

Digital signatures are used to certify the authenticity of a document and also to verify the authenticity and identity of document signers. Digital signatures also establish the state of the document at the time it was signed and make it possible to provide alerts to document recipients indicating whether or not the document has been changed since being signed. A digital signature is an electronic signature that incorporates cryptographic methods of originator authentication, allowing the identity of the signer and the integrity of the data to be verified. The regulations adopted by the Secretary of State that govern the use of digital signatures for use by public entities in California are found in the California Code of Regulations, Title 2, Division 7, Chapter 10 Digital Signatures, accessible using the following URL:

http://www.sos.ca.gov/administration/regulations/current-regulations/technology/digital-signatures/

As required by *Reference Joint Appendix* JA7.6.2.2.4, JA7.6.3.2.4, and JA7.7.1.4, when concluding the document registration procedure, the Data Registry must apply a digital signature to the electronically signed compliance document (PDF) using the Data Registry Provider's digital certificate issued by a certificate authority approved by the California Secretary of State.

The transmission package for the registered compliance document which contains the XML data corresponding to the information reported on the compliance document PDF must also be digitally signed, but use of a certificate authority approved by the California Secretary of State is not required for digitally signing the transmission package data.

Digital signatures for Title 24, Part 6 electronic compliance documents and data should conform to the applicable conventions described in Sections 5.2, 5.3, 5.4, 5.5, and 5.6 below.

5.2 Digital Certificates and Certificate Authorities

Digital certificates protect against impersonation, certifying that a public key belongs to a specified entity. They are issued by a Certificate Authority. A digital certificate binds a public key to its owner, whether that owner is an individual, a software application, or some other entity. Digital certificates are also known as public key certificates, because they give assurances about the ownership of a public key when an asymmetric key scheme is used. A digital certificate contains the public key for an entity and is a statement that the public key belongs to that entity.

If public keys are sent directly by their owner to another entity, there is a risk that the message could be intercepted and the public key substituted with a different key. This is known as a "Man in the Middle Attack". The solution to this vulnerability is to exchange public keys through a trusted third-party, thus the user has a strong assurance that the public key is authentic. The trusted third-party, called a Certificate Authority (CA) incorporates the key into a digital certificate. Data Registry digital signatures for registering California Title 24, Part 6 compliance document PDF's must use a CA approved by the State of California. A list of approved digital signature certification authorities can be accessed using the following URL:

http://www.sos.ca.gov/administration/regulations/current-regulations/technology/digital-signatures/approved-certification-authorities

5.3 Document Components That Must Be Digitally Signed

At the conclusion of the document registration procedure, the compliance document PDF, and also the XML data corresponding to the information reported on the PDF are expected to be contained in a transmission package as described in Section 4.4. At such time as the Energy Commission may approve a document repository, then a copy of the completed transmission package is expected to be exported to the Energy Commission Document Repository as described in Section 3.1 and *Reference Joint Appendix JA7.7.1.4.* A copy of the completed transmission package is expected to be retained by the Data Registry.

When exporting the registered compliance document PDF or data, there are two digital signature use cases to consider.

Use Case 1: An authorized user of the Data Registry downloads a copy of a registered compliance document PDF and must verify the Provider's digital signature once the PDF is downloaded to the authorized user's computer. The user may also transmit the PDF file to others who will need to verify the Data Registry Provider's digital signature. These users do not want or need the XML data corresponding to the information reported for that compliance document.

Use Case 2: The Data Registry Provider exports a completed transmission package to a document repository or to someone who requested both the registered compliance document PDF and the XML data corresponding to the information reported on the PDF. Once received, the requestor will need to verify the authenticity of both the registered compliance document PDF and also the XML data contained in the completed transmission package.

5.3.1 Digital Signing Requirements for the Registered Compliance Document PDF

a. The registered compliance document PDF must be digitally signed at the time the document is registered using the Data Registry Provider's digital certificate issued by a certificate authority approved by the California Secretary of State.

b. Data Registries should extract the digitally signed compliance document PDF from the transmission package for export to a user when only the PDF is required by the user. It must be possible for the user to verify the PDF's digital signature by opening it with freeware such as Adobe Acrobat Reader

c. If an export to a user of the registered compliance document PDF is contained in a transmission package, it must be possible for the user to extract the digitally signed PDF and verify the PDF's digital signature by opening it with freeware such as Adobe Acrobat Reader.

5.3.2 Digital Signing Requirements for the Transmission Package

a. The transmission package must contain the compliance document PDF file that was digitally signed at the time the document was registered using the Data Registry Provider's digital certificate issued by a certificate authority approved by the California Secretary of State. If the transmission package is exported to a user, it must be possible for the user to extract the digitally signed PDF from the transmission package and verify the PDF's digital signature by opening it with freeware such as Adobe Acrobat Reader.

b. The transmission package must contain the XML data corresponding to the information reported on the registered compliance document PDF.

c. The transmission package should contain the data used to provide the input to the Title 24, Part 6 compliance software tool used to generate a registered performance Certificate of Compliance PDF contained in the transmission package.

d. The entire contents of the transmission package must be digitally signed at the conclusion of the registration procedure - signed independently of the digital signing of the compliance document PDF. The digital signing of the transmission package is not required to use a digital certificate issued by a certificate authority approved by the California Secretary of State

e. To keep the XML data and the PDF report linked, the Data Registries must retain the entire digitally signed transmission package.

5.3.3 Digital Signature Appearance.

The signature appearance is how the signature is displayed to the user on the completed compliance document PDF . When the compliance document PDF is signed, the signature appearance becomes part of the signed document. It is not part of the signature.

5.3.3.1 The Content of the Digital Signature Appearance

Provide the following text in the digital signature appearance:

"Digitally signed by [Data Registry Provider's name]. This digital signature is provided to secure the content of this registered document, and in no way implies Registration Provider responsibility for the accuracy of the information."

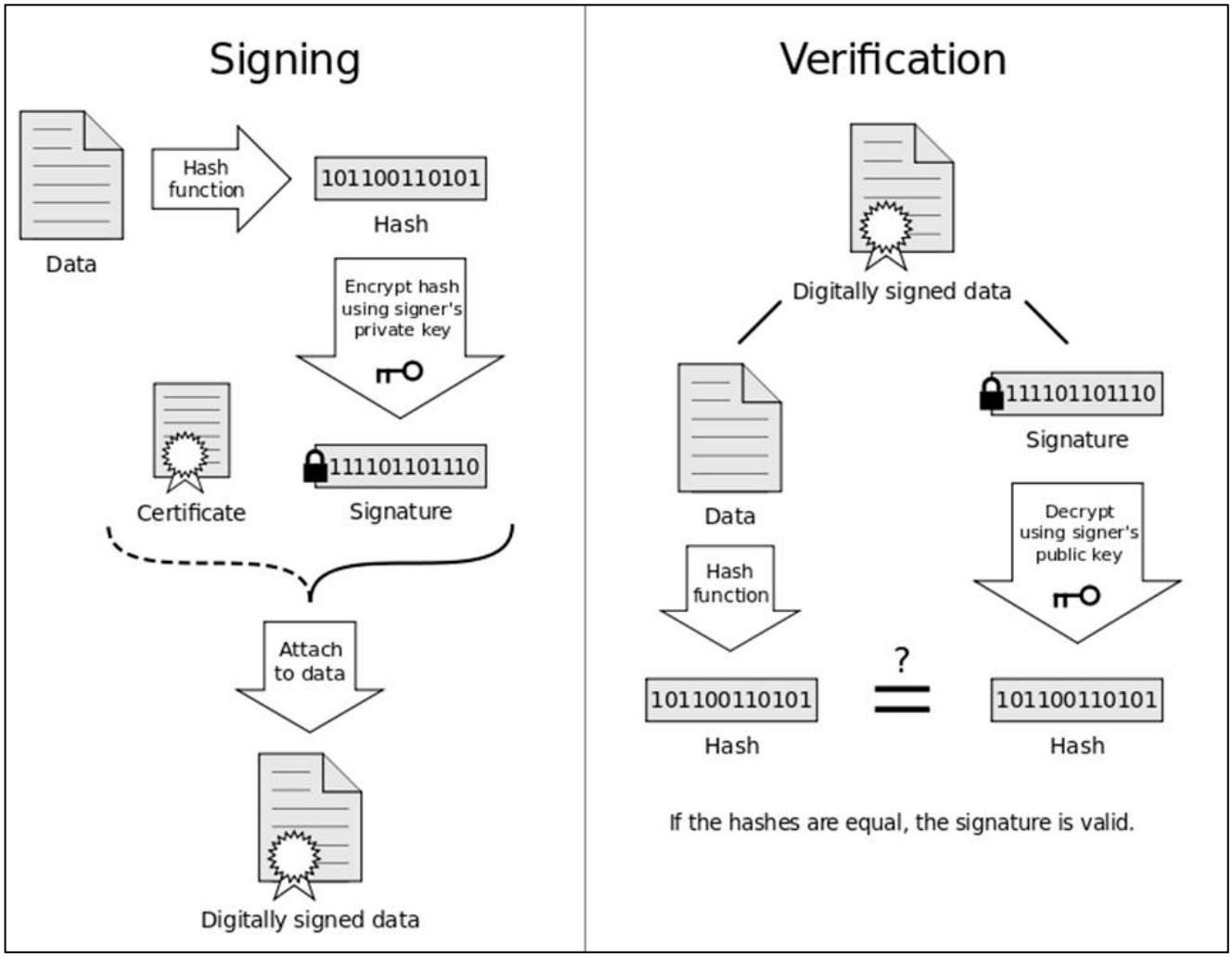
Do not include any other information such as graphic(s), watermark(s), date, or time stamps with the digital signature appearance.

5.3.3.2 Placement of Digital Signature Appearance

Place the digital signature appearance once at the end of the compliance document, in a location that follows the responsible person's signature block.

Figure 5-1 describes the steps in the digital signing process and the digital verification process which involves generating a hash and then applying the encryption key.

Figure 5-1. Process Flow Diagram for Digitally Signing a Document, and Verifying the Digital Signature



5.4 Considerations for Data Registry Digital Certificate Solutions

5.4.1 Digital Certificates for use by Data Registry Providers

A digital certificate is attached to an electronic document to signify the sender's approval with their digital signature, a hash of the contents, and their public key for validation. A digital certificate also contains information such as the sender's name, the period for which the digital signature is valid, and the Certificate Authority (CA) that issued the digital certificate.

A CA issues digital certificates to a person or organization after verifying the information on their application. Since the initial development of digital signatures and digital certificates, companies and government agencies have implemented digital signature policies and published lists of approved CAs. California's Secretary of State publishes a list of approved CAs on their website accessible at:

http://www.sos.ca.gov/administration/regulations/current-regulations/technology/digital-signatures/approved-certification-authorities

Data Registry Providers are required to assign their digital signature to registered compliance documents (PDF's) using a digital certificate issued by a CA approved by the Secretary of State. Digital certificate solution options vary with the volume of digital signatures assigned annually. The following are examples of different digital certificate products from approved CAs.

5.4.2 Manual Signing

Most CAs offer solutions that require manual signing of digital certificates. Some have limits on the number of signatures (up to 5,000 annually) and prices range from $400 to $700 per year. These systems come with a USB stick that contains the digital certificate and processing software that includes time stamping each digital signature, so it will be valid even after the digital certificate expires. Companies with a limited number of signatures per year may sign each certificate manually; however for Data Registry Providers with 20,000 to 200,000 plus signatures per year, manual signing is not a practical solution.

5.4.3 Automatic Signing

CAs offer automated solutions, usually with unlimited signatures, for an annual fee plus the purchase of computer hardware that contains the digital certificate and processes digital signature requests including the time stamping. CAs who are partners of Adobe's Certified Document Services (CDS) program are required to use hardware that is compliant with the NIST computer security standard FIPS 140-2. This is usually referred to as the Hardware Security Module (HSM) and comes in two forms. For systems that have just one server, an internal PCI card is the hardware solution. For systems that have multiple application servers, the HSM is an external appliance.

5.4.4 Typical Vendor Pricing

Because the registered and signed compliance documents are in PDF format, and the digital signature must be verifiable using freeware such as Adobe Acrobat Reader, CAs who are on the Adobe Approved Trust List (AATL) are likely candidates for Data Registry Providers to consider; however, the candidate must also be on the Secretary of State's list of approved CAs. The Energy Commission does not recommend or endorse any CA, but in order to demonstrate a pricing example for digital signatures, the following information is provided.

One CA offers an automated solution that provides unlimited digital signatures for $15,000 per year. Their single server PCI card based HSM ranges from $5,000 to $7,000. The multiple server external appliance based HSM ranges from $12,000 to $15,000. Applying this pricing to a full service Data

Registry with approximately 200,000 signatures per year, the cost per registered compliance document would be $0.15 the first year, and $0.075 each year after that.

5.4.5 California Secretary of State Approved CAs and Adobe's Approved Trust List of CAs

CAs on the California Secretary of State list offer various services, and some specialize in providing services to government agencies. Refer to Table 5-1 below for a comparison of approved CA's. Those CAs who are also on Adobe's Approved Trust List (AATL) of organizations are identified in the second column. Adobe states the AATL members provide certificates that enable creation of trusted digital signatures whenever the signed document is opened in Adobe Reader or Acrobat. The information in Table 5-1 is current as of September, 2015.

Table 5-1 California Secretary of State List of Approved Certificate Authorities

California Secretary of State list of Approved CAs http://www.sos.ca.gov/administration/regulations/current-regulations/technology/digital-signatures/approved-certification-authorities	**CAs also on Adobe Approved Trust List (AATL)** https://helpx.adobe.com/acrobat/kb/approved-trust-list1.html
Comodo Certification Authority	
DigiCert, Inc.	DigiCert, Inc.
DocuSign, Corporation	
Entrust, Inc.	Entrust, Inc.
Esignit.org	
GeoTrust, Inc.	
GlobalSign, Inc.	GlobalSign, Inc.
IdenTrust, Inc.	
Thawte, Inc.	
Symantec Corporation	Symantec Corporation

5.5 CBECC Software Output Data Security and Authentication for the Performance Certificate of Compliance

The Residential and Nonresidential CBECC Compliance Manager-based software (compliance software) uses digital signing when generating analysis data for submission to the Report Generator

for creating the Certificate of Compliance. Each version of the compliance software employs a unique RSA algorithm-based public/private key pair to sign the data prior to sending it to the Report Generator.

When transmitting data to the RG, the compliance software communicates using SSL (Secure Sockets Layer-HTTPS) security technology to encrypt the communication. The RG will only accept HTTPS requests.

In addition to this basic authentication, the signed data is utilized to determine a watermarking status for compliance documents. Thus, in addition to the signed analysis output data, the compliance software sends parameters that the RG uses to determine how to process a request. These parameters include a "hash digest" or fixed length of arbitrary data that is based on the specific content of the analysis data; also the public key for the signature; plus a number of additional tokens. The RG reads the public key and compares the additional tokens to authenticate the connection made by the software. Once authenticated, the RG verifies the signature, processes the data, and may apply a watermark depending on the results of the verification.

5.6 Report Generator Output Data Security and Authentication for the Performance Certificate of Compliance

The RG employs XML digital signatures so that the Certificate of Compliance Registration Package produced by the RG can be verified by an approved Data Registry, thus the Data Registries must ensure that both the data and PDF documents used for registration have not been tampered with prior to submission to the Data Registry. This verification is accomplished using Public Key Infrastructure (PKI) that employs a pair of public/private keys.

The RG, using a secure private key, creates a hash, or fixed length of arbitrary data, that is based on the specific content of the data that has been processed. Any change made to the data being signed would result in a different hash value if that changed data were to be signed again using the same private key. This hash is the signature for that data.

The signed data can be verified by using the public key associated with the signature. Because the private key used to sign the data is secret, PKI uses the public key to verify that the data matches the signature provided. Data Registry Providers are given the public key that can be used to verify signed data.

The XML signing uses an "enveloped" signature, meaning that the signature is included in an XML element inside the data itself.

6 Document Configuration Rules

6.1 Overview

High level document configuration requirements are specified in *2016 Reference Joint Appendix JA7*. Section JA7.5.6 requires that Data Registries shall be capable of tracking all compliance documentation and maintaining the correct associations between related documents, including revisions and completion statuses for all documents within a building project. Section JA7.5.6.1 from *2016 Reference Joint Appendix JA7* is copied into Section 6.2.1 below. Additional guidance for completion of the Project Status Report is given in Section 6.2.2.

6.2 Project Status Reports

6.2.1 Project Status Report Requirements specified in *2016 Reference Joint Appendix JA7*.

6.2.1.1 Project Status Reports (from JA7.5.6.1)

The status of completion of a project shall be reported by the Data Registry.

The Data Registry shall determine the documents required for a project based on the Certificate of Compliance and maintain a summary that reflects the current status of completion of the required documents and shall be readily accessible to authorized users of the Data Registry. Access to the report shall be facilitated by use of search parameters relevant to the project as listed in Sections JA7.5.6.1.1 and JA7.5.6.1.2.

Enforcement Agencies may be authorized to enter notations into project records in Data Registries to communicate plan check and field inspection information to builders, designers, installers and raters.

The project status report shall be made available in a printable format.

Minimum information requirements for the project status report shall include the following:

6.2.1.2 Project Status Report Information for Residential Projects (from JA7.5.6.1.1)

a. Project name.

b. Project location (or address).

c. Listing of the Certificate of Compliance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

d. Listing of the Certificate of Installation documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

e. Listing of the Certificate of Verification documents required; date registered or indicate not complete if the document record has been started but is not yet registered); registration number.

f. Listing of the mandatory measure options required; options selected (refers to the Certificate of Installation and Certificate of Verification documentation).

6.2.1.3 Project Status Report Information for Nonresidential Projects (from JA7.5.6.1.2):

Note: Nonresidential Document registration is contingent upon approval of a nonresidential Data Registry by the Commission.

a. Project name.

b. Project location (or address).

c. Listing of the Certificate of Compliance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

d. Listing of the Certificate of Installation documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

e. Listing of the Certificate of Acceptance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

f. Listing of the Certificate of Verification documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number.

6.2.2 Additional Guidance for Producing Residential Project Status Reports

6.2.2.1 Mandatory Measure Compliance Alternatives Determined at Installation Phase

This section provides additional guidance for the topic identified in section 6.2.1.2 f above.

When a mandatory requirement allows for compliance alternatives to be determined at the time of installation by the installing contractor, the Project Status Report cannot determine which compliance documents will be required for those features, if based only on the information given on the Certificate of Compliance.

Example Use Case - Compliance with Standards Section 150.0(m)13:

a. The mandatory requirements in Section 150.0(m)13B for verification of ducted cooling system airflow rate and fan efficacy provides an exception which allows for use of an alternative compliance method when installation of a duct design that conforms to Table 150.0-B or Table 150.0-C was used. Thus at the time of installation of the space conditioning system, the installer must select one of these options for compliance. Until the installing contractor selects an option for compliance and registers the applicable Installation Certificate (CF2R-MCH-01), the Data Registry will be unable to determine whether a MCH-22 and MCH-23 will be required to document the airflow rate and fan efficacy measurements, or otherwise whether a MCH-28 will be required to document the alternative duct design compliance option specified by Table 150.0-B or C.

Generally: When a Certificate of Compliance is registered for a project and the subsequent Certificate of Installation and Certificate of Verification compliance documents for a feature cannot be determined until after installation of the feature, the Project Status Report should disclose the optional compliance choice(s) that must be determined by the installer at installation. After the installer determines the method of compliance and registers the applicable Certificate of Installation, the Project Status Report should be updated to report the project's full set of compliance document requirements consistent with the installer's compliance option choice.

Continuation of the 150.0(m)13B Example Use Case:

b. After a Certificate of Compliance for the project is registered, but prior to registration of a CF2R-MCH-01 Certificate of Installation, the Project Status Report should indicate two options are available for compliance for the system; either a MCH-22 and MCH-23 will be required or, alternatively, a MCH-28 will be required.
c. After a CF2R-MCH-01 for the dwelling is registered, if the MCH-01 determines airflow rate and fan efficacy verification will be documented for the system, the Project Status Report should indicate a MCH-22 and MCH-23 will be required. Otherwise, if the MCH-01 determines that the alternative compliance method using the Table 150.0-B or Table 150.0-C duct design was used, then the Project Status Report should indicate a MCH-28 will be required.

6.2.2.2 Reporting Non-default Data Inputs

To streamline data entry for project compliance documents, many data fields have specified a default value that is expected to be correct for most project documentation situations. The user may leave the default value unchanged if it is correct, thus the user should not have to perform any data entry actions for these fields if the default value is correct.

When Compliance Document data field rules allow overriding a default value, and when the user elects to override that default value, the Project Status Report should include an advisory message describing the:

- Data field name/identification for the overridden data.
- Default value for the data field.
- New value that was input as an alternative to the default value for the data field.

Allowing a user to override a default value may simplify the completion of project compliance documents by allowing the users the flexibility to avoid having to make revisions to parent documents when reporting features that are inconsistent with specifications on parent documents, but are nonetheless still in compliance with the Standards.

Data Registry staff should not be required to determine whether the overridden/new data value complies with the Standards as part of the document registration process. The enforcement agency review of the project documentation at final inspection, or HERS quality assurance procedures, may (or may not) result in determinations/directives to revise one or more of the affected compliance documents or make changes to the feature(s) that were installed.

Example Use Case:

a. The CF1R-PRF-01 specifies a single-zone ducted space cooling system with a single-speed condensing unit; the builder upgrades the dwelling to install a multi-zone ducted space cooling system with no bypass duct and a multi-speed compressor.
b. On the CF2R-MCH-01 for the dwelling, the values in D09 and D10 must be overridden to accurately report the space conditioning system installed is Zonally Controlled and the Condenser is Multi-Speed.
c. On the project Summary Report for the CF2R-MCH-01 the following messages must be reported:

   Section D Field 09 Default Value Overridden:
   - Default Value = Not Zonal
   - Entered Value = Zonally Controlled

   Section D Field 10 Default Value Overridden:
   - Default Value = Single-Speed
   - Entered Value = Multi-Speed

d. An enforcement agency or HERS rater review of the overridden data finds that the compliance requirements for the Zonally Controlled system are the same as the requirements for the Not

Zonal system. Since the compliance requirements are the same for the substitution, there is no need to revise the CF1R-PRF-01.

6.2.2.3 Delayed HERS Verification of Refrigerant Charge

a. Excerpt from RA2.4.4:

"If necessary to avoid delay of approval of dwelling units completed when outside temperatures are below 55°F, the enforcement agency may approve compliance with the refrigerant charge verification requirements when installers have used the Weigh-in Charging Method described in Reference Residential Appendix RA3, Section RA3.2.3.1 and have not used the Section RA3.2.3.2 option for HERS verification compliance. This approval will be on the condition that installers submit to the enforcement agency a registered Certificate of Installation that includes a signed declaration indicating agreement to return to correct refrigerant charge if a HERS Rater determines at a later time when the outside temperature is 55°F or above, that correction is necessary. Installers must also notify homeowners that their systems have not had their charge verified. The HERS Provider shall track these projects to ensure a HERS Rater conducts the required refrigerant charge verification for all such systems."

b. Excerpt from Certificate of Installation CF2R-MCH-25c for the Weigh-in Charging Procedure; Reference: Section F - Additional Requirements; field 04:

"When applicable and if necessary to avoid delay of approval of dwelling units completed when outside temperatures are below 55°F, the enforcement agency may approve compliance with the refrigerant charge verification requirements based on registration of this CF2R-MCH-25, documenting use of the RA3.2.3.1 HVAC Installer Weigh-In Charging Procedure when the optional Section RA3.2.3.2 HERS Rater Observation of Weigh-In Charging Procedure is not used. As condition for such enforcement agency approval, the responsible person's signature on this compliance document affirms the installer agrees to return to correct refrigerant charge if a HERS Rater determines at a later time, when the outside temperature is 55°F or greater, that refrigerant charge correction is necessary."

c. Additional guidance for HERS Provider tracking and follow-up communications:

In order for the HERS Provider Data Registry to track these conditionally approved cold weather refrigerant charge verifications, and to ensure a HERS Rater conducts the required refrigerant charge verification when the outdoor air temperature is warmer, the Provider must be informed that the dwelling was approved at final inspection based on registration of only a CF2R-MCH-25, documenting use of the RA3.2.3.1 installer weigh-in charging procedure as allowed by RA2.4.4.

Note: there are no explicit requirements in the Standards or in the Reference Appendices that direct the enforcement agency to disclose to the HERS Provider Data Registry any information about a project's building permit status, or the status of a required refrigerant charge verification. Therefore if the enforcement agency does not notify the Data Registry that a building was approved based on registration of only the CF2R-MCH-25, and if the required CF3R-MCH-25 has not been registered to complete the full set of required project documentation, it may be necessary for the Data Registry staff to follow up with the enforcement agency to determine the status of the building permit, and the status of the refrigerant charge verification for the building to determine whether refrigerant charge verification tracking is needed.

d. Additional guidance for Data Registry Project Status Reporting for the necessary RA2.4.4 follow-up:

   The Data Registry requirements in *Reference Joint Appendix* JA7.5.6.1 state: "enforcement agencies may be authorized to enter notations into project records in data registries to communicate plan check and field inspection information to builders, designers, installers, and raters."

   Thus the Data Registry should make available data fields in the Project Status Report that enable enforcement agency persons, or HERS Raters, or Data Registry staff to flag a CF2R-MCH-25c for the project as requiring HERS verification at a later time when the weather is warmer, when the enforcement agency has approved the dwelling based on registration of only a CF2R-MCH-25. The Data Registry should also make available the capability for users to enter notes that provide additional information useful for determining how and when the needed follow-up HERS verification should be conducted, and if applicable, who should be contacted to perform the follow-up HERS verification.

e. Additional Guidance for Data Registry follow-up communications for prompting for HERS verification according to RA2.4.4:

   Once the Data Registry has set a flag to indicate that a follow-up HERS verification is required, the Data Registry can be configured to automatically distribute reminder communications to the appropriate persons at predetermined time(s) or when predetermined conditions such as warmer weather are met.

6.3 General Configuration Rules

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-NCB-01-E	Prescriptive Certificate of Compliance	Residential Newly Constructed Buildings, and Additions Greater Than 1,000 ft^2 (Prescriptive)	Prompt user to select compliance method and project scope. If compliance method is prescriptive and project scope is newly constructed building or prescriptive newly constructed addition greater than 1,000 ft^2, then require one CF1R-NCB-01 for the building. The CF1R-NCB-01 is applicable to single family and multifamily buildings.
CF1R-ADD-01-E	Prescriptive Certificate of Compliance	Residential Building Additions less than 1,000 ft^2 (Prescriptive)	Prompt user to select compliance method and project scope. If compliance method is prescriptive and project scope is newly constructed addition less than or equal to 1,000 ft^2, then require one CF1R-ADD-01 for the building. The CF1R-ADD-01 is applicable to single family and multifamily buildings.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-ALT-01-E	Prescriptive Certificate of Compliance	Residential Building Alterations (Prescriptive)	Prompt user to select compliance method and project scope. If compliance method is prescriptive and project scope is alteration to one or more building components including an alteration to a space conditioning system, then require one CF1R-ALT-01 for the building. The CF1R-ALT-01 is applicable to single family and multifamily buildings. If the alteration is limited to only space conditioning system(s), then instead require use of the CF1R-ALT-02 which is applicable to only space conditioning system alterations.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-ALT-02-E	Prescriptive Certificate of Compliance	HVAC Alterations	Prompt user to select compliance method and project scope. If compliance method is prescriptive and project scope is limited to alterations to space conditioning systems contained in a single family dwelling unit (heating systems, cooling systems, duct systems), then require one CF1R-ALT-02 for the single family dwelling unit. Elseif compliance method is prescriptive, and a CF1R-ALT-01 or CF1R-ADD-01 are used for the project, and the building type is single family, then require one CF2R-ALT-02 for the single family dwelling identified on the CF1R that requires installation or alteration of a space conditioning system. Elseif compliance method is prescriptive, and a CF1R-ALT-01 or CF1R-ADD-01 are used for the project, and the building type is multifamily, then require one CF2R-ALT-02 for each dwelling unit in the multifamily building identified on the CF1R that requires installation or alteration of a space conditioning system.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-ENV-02-E	Prescriptive Certificate of Compliance	Area Weighted Average Calculation Worksheet	Prompt the user to declare whether they need to use an area weighted average to meet any of the mandatory U-values or SHGC values. User elects to register CF1R-ENV-02 when an area weighted average value is required to be calculated to demonstrate overall envelope compliance when a non-compliant value for an envelope feature is entered on the CF1R for the project. This worksheet is used to calculate the area-weighted average U-factors for building envelope features such as walls, roofs, floors, mass, and fenestration/glazing U-factors or Solar Heat Gain Coefficient (SHGC) values for prescriptive compliance.
CF1R-ENV-03-E	Prescriptive Certificate of Compliance	Solar Heat Gain Coefficient (SHGC) Worksheet	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01 CF1R-ALT-01 CF1R-ADD-01 and the value for Exterior Shading Device ≠ "none"; then require one CF1R-ENV-03 for the project.
CF1R-ENV-04-E	Prescriptive Certificate of Compliance	Cool Roof and SRI Worksheet	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01 CF1R-ALT-01 CF1R-ADD-01 Require one CF1R-ENV-04 for each roofing feature listed on the CF1R that lists a value for proposed SRI.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-PLB-01-E	Prescriptive Certificate of Compliance	Hydronic Heating System Worksheet	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01 CF1R-ALT-01 CF1R-ADD-01 CF1R-ALT-02, and the heating system type identified on the CF1R is one of the following types: *hydronic; *combined hydronic *hydronic+forced air; *combined hydronic+forced air; then require one CF1R-PLB-01 for each of the hydronic systems listed on the CF1R.
CF1R-SRA-01-E	Prescriptive Certificate of Compliance	Solar Ready Buildings	Require one CF1R-SRA-01 doc for every newly constructed single family dwelling, and one CF1R-SRA-01 for every newly constructed low-rise multifamily building.
CF1R-SRA-02-E	Prescriptive Certificate of Compliance	Minimum Solar Zone Area Worksheet	When CF1R-SRA-02 is required by CF1R-SRA-01, provide one CF1R-SRA-02 for each building.
CF1R-STH-01-E	Prescriptive Certificate of Compliance	OG 300 Solar Water Heating System Worksheet	When the CF1R-NCB-01 indicates requirement for Solar Heated Domestic Hot Water heating or the CF1R-PRF-01 indicates requirement for compliance credit for Solar Heated Domestic Hot Water heating, query the user to provide the rating methodology from Solar Rating and Certification Corporation either OG300 or OG100. If the user selects OG300 compliance shall require use of one CF1R-STH-01 for each solar water heating system installed.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF1R-STH-02-E	Prescriptive Certificate of Compliance	OG 100 Solar Water Heating System Worksheet (California F-Chart)	When the CF1R-NCB-01 indicates requirement for Solar Heated Domestic Hot Water heating or the CF1R-PRF-01 indicates requirement for compliance credit for Solar Heated Domestic Hot Water heating, query the user to provide the rating methodology from Solar Rating and Certification Corporation either OG300 or OG100. If the user selects OG100 compliance shall require use of one CF1R- STH-02 for each solar water heating system installed.
CF2R-ENV-01-E	Certificate of Installation	Fenestration Installation	If the CF1R specifies fenestration features, require one CF2R-ENV-01 for each CF1R. Elseif the CF1R does not specify fenestration features, a CF2R-ENV-01 is not required.
CF2R-ENV-03-E	Certificate of Installation	Insulation Installation	If the CF1R specifies compliance for insulation features, require one CF2R-ENV-03 for each CF1R. Elseif the CF1R does not specify insulation features, a CF2R-ENV-02 is not required.
CF2R-ENV-04-E	Certificate of Installation	Roofing; Cool Roofs	If the CF1R specifies compliance for Radiant Barrier features, require one CF2R-ENV-04 for each CF1R. Elseif the CF1R does not specify Radiant Barrier features, a CF2R-ENV-04 is not required.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-ENV-20a-H	Certificate of Installation	Building Envelope Air Leakage Single-Point Test with Manual Meter	When the CF1R indicates requirement for Envelope Leakage HERS verification for the dwelling, compliance shall require use of any one of the applicable ENV-20 variants (a, b, c, d, e).
CF3R-ENV-20a-H	Certificate of Verification		
CF2R-ENV-20b-H	Certificate of Installation	Building Envelope Air Leakage Single-Point Test with Automatic Meter	
CF3R-ENV-20b-H	Certificate of Verification		
CF2R-ENV-20c-H	Certificate of Installation	Building Envelope Air Leakage Multi-Point Test	
CF3R-ENV-20c-H	Certificate of Verification		
CF2R-ENV-20d-H	Certificate of Installation	Building Envelope Air Leakage Repeated Single Point with Manual Meter	
CF3R-ENV-20d-H	Certificate of Verification		
CF2R-ENV-20e-H	Certificate of Installation	Building Envelope Air Leakage Repeated Single Point with Automatic Meter	
CF3R-ENV-20e-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF3R-ENV-21-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Framing Stage for Batt, Loose Fill, and SPF	When the CF1R indicates a requirement for QII HERS verification for the dwelling, compliance shall be demonstrated using all of the QII HERS verification compliance docs that are applicable to the dwelling (CF3R-ENV-21, 22, 23, 24). Upon Registration of a CF1R that indicates a requirement for QII verification, the Data Registry Provider shall notify and require the builder to report to the Data Registry which QII docs are applicable to the dwelling. The Data Registry Provider shall also notify and require the builder to coordinate with the HERS Rater to schedule the required verifications at the applicable stages of construction. The HERS Rater shall verify that all applicable QII docs have been used.
CF3R-ENV-22-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Ceiling/Roof Deck	
CF3R-ENV-23-H	Certificate of Verification	Quality Insulation Installation (QII) Insulation Stage	
CF3R-ENV-24-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Framing Stage for SIP and ICF	
CF3R-EXC-20-H	Certificate of Verification	HERS Verification for Existing Conditions for performance compliance for alterations. Required as prerequisite to registration of a CF1R-PRF for an altered dwelling.	When credit for existing conditions is used on the CF1R, as condition for CF1R registration, an EXC-20 that verifies the existing condition claimed on the CF1R shall first be registered.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules

CF2R-LTG-01-E	Certificate of Installation	Lighting - Single Family Dwellings	If building type on CF1R = single family, then
			if scope on CF1R = Newly Constructed Building, then
			require one CF2R-LTG-01 per dwelling unit
			
			else prompt the user to declare whether the scope of the project includes lighting, then
			
			if scope includes lighting, then require one CF2R-LTG-01 for the dwelling unit
			
			else CF2R-LTG-01 is not required.

CF2R-LTG-02-E	Certificate of Installation	Lighting - Multifamily Dwellings	If building type on CF1R = multifamily, then
			if scope on CF1R=Newly Constructed Building, then
			require one CF2R-LTG-02 for each dwelling unit;
			
			else prompt the user to declare whether the scope of the project includes lighting, then
			
			if scope includes lighting, then require one CF2R-LTG-02 for each dwelling unit
			
			else CF2R-LTG-02 is not required.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-01a-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Performance Compliance	If CF1R type = CF1R-PRF, then require one MCH-01a for each dwelling unit for which there are HVAC system compliance requirements given on the CF1R.
CF2R-MCH-01b-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Prescriptive Alterations	If CF1R type = CF1R-ALT-02, then require one MCH-01b for each dwelling unit for which there are HVAC system compliance requirements given on the CF1R-ALT-02 (refer also to the rules for configuration of the CF1R-ALT-02 above).
CF2R-MCH-01c-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Prescriptive Newly Constructed Buildings	If CF1R type = CF1R-NCB, then require one MCH-01c for each dwelling unit for which there are HVAC system compliance requirements given on the CF1R.
CF2R-MCH-02-E	Certificate of Installation	Whole House Fan	For single family projects in Climate Zones 8, 9, 10, 11, 12, 13, 14; if certificate of compliance type is prescriptive (ALT, ADD, NCB), then require one CF2R-MCH-02 for the dwelling. Elseif the Certificate of Compliance type is performance (PRF), then if ventilation cooling system type from the CF1R is whole house fan, then require one CF2R-MCH-02 for the dwelling; else, CF2R-MCH-02 is not required for the dwelling. Note: the whole-house fan requirements are not applicable to multifamily buildings, thus CF2R-MCH-02 docs are not applicable to multifamily dwellings.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-04-E	Certificate of Installation	Evaporative Coolers	Require one CF2R-MCH-04 for each evaporative cooling system installed in a dwelling unit when the Cooling System Type given on the CF2R-MCH-01 is one of the following types: *evaporative - direct *evaporative - indirect *evaporative – indirect-direct
CF2R-MCH-20a-H	Certificate of Installation	Duct Leakage Measurement New System	When MCH-20 is required by MCH-01, provide one MCH-20 for each space conditioning system.
CF3R-MCH-20a-H	Certificate of Verification		
CF2R-MCH-20b-H	Certificate of Installation	Duct Leakage Measurement Low Leakage Ducts in Conditioned Space Compliance Credit;	
CF3R-MCH-20b-H	Certificate of Verification		
CF2R-MCH-20c-H	Certificate of Installation	Duct Leakage Measurement Low Leakage Air-Handling Units	
CF3R-MCH-20c-H	Certificate of Verification		
CF2R-MCH-20d-H	Certificate of Installation	Duct Leakage Measurement Altered (Existing) System	
CF3R-MCH-20d-H	Certificate of Verification		
CF2R-MCH-20e-H	Certificate of Installation	Duct Leakage Measurement Sealing of All Accessible Leaks	
CF3R-MCH-20e-H	Certificate of Verification		
CF2R-MCH-21-H	Certificate of Installation	Duct Location Verification	When MCH-21 is required by MCH-01, provide one MCH-21 for each space conditioning system.
CF3R-MCH-21-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-22a-H	Certificate of Installation	Forced Air System Fan Efficacy (Watt/cfm) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	When MCH-22 is required by MCH-01, provide one MCH-22 for each space conditioning system.
CF3R-MCH-22a-H	Certificate of Verification		
CF2R-MCH-22b-H	Certificate of Installation	Forced Air System Fan Efficacy (Watt/cfm) Zonally Controlled Systems in Every Zonal Control Mode	
CF3R-MCH-22b-H	Certificate of Verification		
CF2R-MCH-23a-H	Certificate of Installation	Forced Air System Airflow Rate (cfm/ton) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	When MCH-23 is required by MCH-01, provide one MCH-23 for each space conditioning system.
CF3R-MCH-23a-H	Certificate of Verification		
CF2R-MCH-23b-H	Certificate of Verification	Forced Air System Airflow Rate (cfm/ton) Zonally Controlled Systems in Every Zonal Control Mode -	
CF3R-MCH-23b-H	Certificate of Verification		
CF2R-MCH-23c-H	Certificate of Verification	Forced Air System Airflow Rate Alternative Compliance (best-that-I-can-do)	
CF3R-MCH-23c-H	Certificate of Verification		
CF2R-MCH-23d-H	Certificate of Installation	Forced Air System Airflow Rate Measurement Only (CFM) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	
CF3R-MCH-23d-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-24a-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	MCH-24 doc only used if called for by MCH-27 docs.
CF3R-MCH-24a-H	Certificate of Verification	Single-Point Test with Manual Meter	
CF2R-MCH-24b-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24b-H	Certificate of Verification	Single-Point Test with Automatic Meter	
CF2R-MCH-24c-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24c-H	Certificate of Verification	Multi-Point Test	
CF2R-MCH-24d-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24d-H	Certificate of Verification	Repeated Single Point with Manual Meter	
CF2R-MCH-24e-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24e-H	Certificate of Verification	Repeated Single Point with Automatic Meter	

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-25a-H	Certificate of Installation	Refrigerant Charge Verification Superheat Method (Standard Charge Procedure)	When MCH-25 is required by MCH-01, provide one MCH-25 for each space conditioning system.
CF3R-MCH-25a-H	Certificate of Verification		
CF2R-MCH-25b-H	Certificate of Installation	Refrigerant Charge Verification Sub-cooling Method (Standard Charge Procedure)	
CF3R-MCH-25b-H	Certificate of Verification		
CF2R-MCH-25c-H	Certificate of Installation	Refrigerant Charge Verification Weigh-in Charging Procedure	
CF3R-MCH-25c-H	Certificate of Verification		
CF2R-MCH-25d-H	Certificate of Installation	Refrigerant Charge Verification - Fault Indicator Display (FID) (embedded in the CF2R MCH-25a,b,e)	
CF3R-MCH-25d-H	Certificate of Verification	Refrigerant Charge Verification Charge Indicator Display (CID) (standalone CF3R-MCH-25d)	
CF2R-MCH-25e-H	Certificate of Installation	Refrigerant Charge Verification Winter Setup	
CF3R-MCH-25e-H	Certificate of Verification		
CF2R-MCH-25f-E	Certificate of Installation	Refrigerant Charge Verification - Packaged System Manufacturer Refrigerant Charge Certification (CF2R only for the f variant)	
CF2R-MCH-26-H	Certificate of Installation	Rated Space Conditioning System Equipment Verification	When MCH-26 is required by MCH-01, provide one MCH-26 for each space conditioning system.
CF3R-MCH-26-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-27a-H	Certificate of Installation	Mechanical Ventilation Continuous Whole-Building Mechanical Ventilation Airflow Fan Vent Rate Method	When MCH-27 is required by MCH-01, provide one MCH-27 for the dwelling unit. Note: the MCH-01b does not report requirements for MCH-27 docs, thus if parent is MCH-01b, then MCH27 is not required for the dwelling unit.
CF3R-MCH-27a-H	Certificate of Verification		
CF2R-MCH-27b-H	Certificate of Installation	Mechanical Ventilation Continuous Whole-Building Mechanical Ventilation Airflow Total Vent Rate Method	
CF3R-MCH-27b-H	Certificate of Verification		
CF2R-MCH-27c-H	Certificate of Installation	Mechanical Ventilation Intermittent Whole-Building Mechanical Ventilation Airflow Fan Vent Rate Method	
CF3R-MCH-27c-H	Certificate of Verification		
CF2R-MCH-27d-H	Certificate of Installation	Mechanical Ventilation Intermittent Whole-Building Mechanical Ventilation Airflow Total Vent Rate Method	
CF3R-MCH-27d-H	Certificate of Verification		
CF2R-MCH-28-H	Certificate of Installation	Return Duct And Filter Grille Design According to Tables 150.0-B or C	When MCH-28 is required by MCH-01, provide one MCH-28 for each space conditioning system according to the MCH-01.
CF3R-MCH-28-H	Certificate of Verification		
CF2R-MCH-29-H	Certificate of Installation	Supply Duct Surface Area and R-Value; Buried Ducts; Deeply Buried Ducts	When MCH-29 is required by MCH-01, provide one MCH-29 for each space conditioning system according to the MCH-01.
CF3R-MCH-29-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-30-H	Certificate of Installation	Central Fan Ventilation Cooling Systems compliance credit	When the CF1R-PRF indicates a Central Fan Ventilation Cooling System (VCS) was used, require one MCH-30 for each Central Fan VCS installed in the dwelling.
CF3R-MCH-30-H	Certificate of Verification		
CF2R-PLB-01-E	Certificate of Installation	Multifamily Central Hot Water System Distribution - NON-HERS	If the building type is multifamily, and the value for Central DHW System Distribution Type on the CF1R ≠ N/A (value ≠ none) and value is not a HERS-verified distribution type, then require one CF2R-PLB-01 for the building; else if the value for Central DHW System Distribution Type on the CF1R = N/A (none), then the CF2R-PLB-01 is not required. The CF2R-PLB-01 is not applicable to single family dwelling units.
CF2R-PLB-02-E	Certificate of Installation	Single Dwelling Unit Hot Water System Distribution - NON-HERS	If the Building Type given on the CF1R is multifamily, require one CF2R-PLB-02 for each dwelling unit in the building that has a water heating system with a non-HERS-verified distribution type value for Dwelling Unit DHW System Distribution Type; Elseif the Building Type given on the CF1R is single family require one CF2R-PLB-02 for the dwelling unit if the dwelling unit contains a water heating system with a non-HERS-verified distribution type value for Dwelling Unit DHW System Distribution Type; Elseif the dwelling does not have a water heating system, a CF2R-PLB-02 is not required.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-PLB-03-E	Certificate of Installation	Pool and Spa Systems	Prompt the user to declare whether the scope of the project includes installation of a new pool or spa, or installation of replacement pool or spa components. If response=yes, then require a CF2R-PLB-03 else if response=no, then CF2R-PLB-03 is not required.
CF2R-PLB-21-H	Certificate of Installation	HERS - Multifamily Central Hot Water System Distribution Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units	If the CF1R-PRF indicates the building type is multifamily, and the value for Central DHW System Distribution Type on the CF1R ≠ N/A (value ≠ none), and the value is a HERS-verified distribution type; then require one PLB-21 for the building; elseif the value for Central DHW System Distribution Type on the CF1R = N/A (none), then the PLB-21 is not required. The PLB-21 is not applicable to single family dwelling units. There are no HERS-verified distribution types applicable to prescriptive compliance, thus a PLB-21 is only applicable to CF1R-PRF doc types.
CF3R-PLB-21-H	Certificate of Verification		

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-PLB-22-H	Certificate of Installation	HERS - Single Dwelling Unit Hot Water System Distribution	If the Building Type given on the CF1R is multifamily, require one PLB-22 for each dwelling unit in the building that has a water heating system with a HERS-verified distribution type value for Dwelling Unit DHW System Distribution Type; Elseif the Building Type given on the CF1R is single family require one PLB-22 for the dwelling unit if the dwelling unit contains a water heating system with a HERS-verified distribution type value for Dwelling Unit DHW System Distribution Type; Elseif the dwelling does not have a water heating system, a PLB-22 is not required. There are no HERS-verified distribution types applicable to prescriptive compliance, thus a PLB-22 is only applicable to CF1R-PRF doc types.
CF3R-PLB-22-H	Certificate of Verification		
CF2R-SPV-01a-E	Certificate of Installation	PV Systems - Photovoltaic Systems Compliance Credits	When the CF1R-PRF-01 indicates compliance credits for Solar Photovoltaic System and the CF1R-SRA-01 indicates that the compliance method equals Residence not in an Applicable Subdivision, require one SPV-01a per building.
CF2R-SPV-01b-E	Certificate of Installation	PV Systems - Exception to Solar Ready Area (SRA) requirements	When the CF1R-SRA-01 indicates that the compliance method equals Permanently Installed Solar Photovoltaic (PV) System, require one SPV-01b per building.
CF2R-SPV-01c-E	Certificate of Installation	PV Systems - PV Compliance Credits + Exceptions to SRA requirements	When the CF1R-PRF-01 indicates compliance credits for Solar Photovoltaic System and the CF1R-SRA-01 indicates that the compliance method equals Permanently Installed Solar Photovoltaic (PV) System, require one SPV-01c per building.

Table 6-1. Document Configuration Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-STH-01-E	Certificate of Installation	Solar Water Heating Systems	When the CF1R indicates use of a solar DHW system for compliance, require one CF2R-STH-01 for each solar DHW system installed in the building.
NRCV-MCH-04a-H	Certificate of Verification	Nonresidential Duct Leakage Measurement New System	One NRCV-MCH-04 shall be required for each duct system identified as requiring duct leakage testing on the Certificate of Compliance.
NRCV-MCH-04c-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Low Leakage Air-Handling Units	
NRCV-MCH-04d-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Altered (Existing) System	
NRCV-MCH-04e-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Sealing of All Accessible Leaks	
NRCV-PLB-21-H	Certificate of Verification	Nonresidential HERS - High Rise Multifamily Central Hot Water System Distribution Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units;	When HERS verification is required by NRCC provide one NRCV-PLB-21 for the building.
NRCV-PLB-22-H	Certificate of Verification	Nonresidential HERS - High Rise Single Dwelling Unit Hot Water System Distribution	When HERS verification is required by NRCC provide one PLB-22 for each Dwelling Unit.

7 Group Sampling Rules for HERS Verification Compliance

7.1 Overview

Residential HERS Verification, Testing, and Documentation Procedures are given in *2016 Reference Residential Appendix RA2*.

For newly constructed buildings, at the builder's option, compliance with HERS field verification and diagnostic testing (HERS verification) requirements may be demonstrated for a group of dwelling units by performing HERS verification on a single dwelling unit sample from a designated group of dwelling units in which the same measure(s) requiring HERS verification has been installed in each dwelling unit in the group. If the builder elects to demonstrate compliance utilizing group sampling, all applicable procedures described in Reference Residential Appendix Sections RA2.6.2, RA2.6.3, and RA2.6.4 must be followed.

For alterations to existing buildings, building owners or their agents may carry out the actions that are assigned to builders in Reference Residential Appendix Sections RA2.1 through RA2.6. Refer to Reference Residential Appendix Section RA2.8 for installer requirements and HERS procedures for alterations to existing buildings.

When a Third Party Quality Control Program is used, the sampling procedure utilized is limited to sampling of a "closed" group as described in Section RA2.6.3. However, the sample tested may be selected and field verified from within a group of up to thirty dwelling units. Refer to Reference Residential Appendix Section RA2.7 for Third Party Quality Control Program requirements.

7.2 General Group Sampling Rules

Group sampling rules are specified in *2016 Reference Residential Appendix RA2*. Relevant sections from 2016 RA2.6 are copied into Section 7.2.1 below for convenience. Additional guidance for administering group sampling processes and registering Certificate of Verification documentation is given in Section 7.2.2.

7.2.1 Group sampling rules specified in *2016 Residential Appendix RA2*

7.2.1.1 Designation of Groups (from 2016 RA2.6.3.1)

After the initial model field verification and diagnostic testing is completed as specified in RA2.6.2, the builder or the builder's authorized representative shall determine a sampling procedure to be

used, and shall designate the dwelling units to include in the group of dwellings that require HERS verification. The maximum number of dwelling units allowed in a sample group may range from five, to seven, to thirty as described in Sections RA2.6.3.3, RA2.6.3.4, and RA2.7 respectively.

If multiple measures requiring HERS verification are installed, each dwelling unit in a designated group shall have the same measures requiring HERS verification as the other dwelling units in the designated group. If some dwelling units have installed a different set of measures requiring HERS verification, those dwelling units shall be in a separate group.

If the dwelling units in a designated group have multiple measures that require HERS verification, sample testing for individual measures may be conducted in any of the dwelling units in the group - it is not required that all of the sample tests for all of the individual measures be completed in the same dwelling unit. Individual measures shall be allowed to be included in a group regardless of whether compliance requires one sample test, or if compliance requires more than one sample test (up to 100 percent sample test rate) be reported for such individual measures.

Dwelling units in a designated group shall all be located within the same enforcement agency jurisdiction and subdivision or multifamily housing development. Refer also to Section RA2.8 for requirements for sample groups applicable to alterations.

If dwelling units have central forced-air space conditioning equipment that introduces outside air into the conditioned space utilizing means that connect outside air ventilation ducts directly to the dwelling unit's central forced air duct system (Central Fan-Integrated Ventilation System or CFI Ventilation System), the CFI ventilation technology shall be considered a separate measure for HERS verification sampling purposes, and dwellings with CFI ventilation systems shall be placed in separate groups from other dwelling units that do not utilize CFI ventilation technology.

7.2.1.2 Group Status - "Open" Groups and "Closed" Groups (from 2016 RA2.6.3.2)

Submittal of the Certificate of Installation information, for at least one dwelling, to the HERS Provider Data Registry, is required in order to "open" a new group. Additional dwellings may be entered into the Registry and included in an "open" group over a period of time, subject to submittal of the Certificate 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, thus the size of a "closed" group may range from a minimum of one dwelling to a maximum of seven dwellings. When a group becomes classified as "closed", no additional dwellings shall be added to the group.

7.2.1.3 Sampling of a "Closed" Group of Up to Seven Dwellings (from 2016 RA2.6.3.3)

The following criteria shall be met as prerequisite to attaining HERS verification compliance for the group:

a. All of the dwelling units contained in the sample group have been identified. A maximum of seven dwellings are allowed to be included in a "closed" sample group for HERS compliance.

b. Installation of all the measures that require HERS verification has been completed in all the dwellings that are entered in the group, and registration of the Certificates of Installation for all the dwellings entered in the group has been completed.

c. The group has been classified as a "closed" group in the Provider Data Registry

d. At the request of the builder or the builder's authorized representative, a HERS Rater shall 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 also each of the other "not-tested" dwellings in the group shall receive a registered Certificate of Verification.

7.2.1.4 Sampling of an "Open" Group of Up to Five Dwellings (from 2016 RA2.6.3.4)

The following criteria shall be met as prerequisite to attaining HERS verification compliance for the group:

a. At least one dwelling unit from the sample group has been identified. A maximum of five dwellings are allowed to be included in an "open" sample group for HERS compliance.

b. Installation of all the measures that require HERS verification shall be completed in all the dwellings that are entered in the group, and registration of the Certificates of Installation for all the dwellings entered in the group has been completed.

c. At the request of the builder or the builder's authorized representative, a HERS Rater shall randomly select one dwelling unit from those currently entered into the "open" sample group for field verification and diagnostic testing. If the dwelling unit meets the compliance requirements, the "tested" dwelling and also each of the other "not tested" dwellings currently entered into the group shall receive a registered Certificate of Verification. If less than five dwelling units have been entered into the group, the group shall be allowed to remain "open" and eligible to receive additional dwelling units. Dwelling units entered into the "open" group subsequent to the compliant HERS verification of the "tested" dwelling shall also receive a registered Certificate of Verification as a "not tested" dwelling subject to receipt of the registered Certificate of Installation by the HERS Provider Data Registry for the dwelling. The group shall be "closed" when it reaches the limit of five dwellings or when the

six month limit for "open" groups has been exceeded, or when the builder requests that the group be closed.

7.2.1.5 Additional Requirements Applicable to Group Sampling Procedures (from 2016 RA2.6.3.5).

The builder or the HERS Rater may request removal of untested dwelling units from a group by notifying the HERS Provider prior to selection of the dwelling sample that will be tested from an "open" or "closed" group and shall provide justification for the change. Removed dwelling units shall be field verified and diagnostically tested individually or shall be included in a subsequent group for sampling.

There are exceptions to the requirement to have completed Certificate of Installation data entered into the HERS Provider Data Registry prior to selection of the dwelling unit to be tested in a group. Some HERS measures require multiple verifications during the construction process. A sample group is not required to be closed before HERS field verification and diagnostic testing can begin for the following measures. For these measures the HERS Rater is allowed to randomly select the dwelling unit to be field verified from those that are at the proper stage of construction to enable the first of the multiple verifications to be completed.

a. **Quality Installation of Insulation** measure requires inspection of the air barrier and inspection of the insulation behind tubs and showers at framing rough-in. Verification of the wall, floor, and ceiling insulation must be completed prior to drywall installation. Attic insulation installation may require follow-up verification.
b. **Buried Ducts** measure requires verification of the duct design prior to verification of the attic insulation.
c. **Duct Surface Area** requires verification of the duct design prior to installation of the attic insulation.

The HERS Rater, with no direction from the installer or builder, shall randomly select one dwelling unit from a "closed" sample group for field verification and diagnostic testing upon receiving the builder's, or builder representative's, request for HERS verification of that group. Alternatively, the HERS Rater shall randomly select one dwelling unit from the dwellings currently entered into an "open" sample group upon receiving the builder's, or builder representative's, request for HERS verification of that group. The HERS Rater shall diagnostically test and field verify the selected dwelling unit. The HERS Rater shall enter the test and/or field verification results into the HERS Provider 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 Data Registry even if the installer immediately corrects the problem. In addition, the procedures in Section RA2.6.4 shall be followed.

If field verification and diagnostic testing determines that the requirements for compliance are met, the HERS Rater shall enter the test results into the HERS Provider Data Registry. Whereupon the Provider shall make available to the HERS Rater, the builder, the enforcement agency, and other approved users of the HERS Provider Data Registry, a registered copy of the Certificate of Verification for the "tested" dwelling, and for all other "not tested" dwelling units entered in the group at the time of the sample test. The registered Certificate of Verification shall report the successful diagnostic testing results and conclusions regarding compliance for the tested dwelling unit. The registered Certificate of Verification shall also provide:

a. Building permit number for the dwelling unit.
b. Registration Number that conforms to the numbering convention specified in Reference Joint Appendix JA7.
c. Group Number that conforms to the numbering convention specified in Reference Joint Appendix JA7.
d. Time and date stamp of the Provider's issuance of the registered Certificate of Verification.
e. Provider's logo, water mark, or official seal.
f. Indication that the dwelling was a "tested" dwelling, or was a "not-tested" dwelling in a sample group.

Whenever the builder changes subcontractors who are responsible for a feature that is being diagnostically field verified and tested, the builder shall notify the HERS Rater of the subcontractor change, and terminate sampling for any affected groups. All dwelling units utilizing features that require HERS verification for compliance that were installed by previous subcontractors or were subject to verification and testing under the supervision of a previous HERS Provider, for which the builder does not have a completed Certificate of Verification, shall be individually tested or included in a separate group for sampling. Dwelling units with installations completed by new subcontractors shall be individually tested or shall be included in a new sampling group.

The HERS Rater shall not notify the builder when sample testing will occur prior to the completion of the work that is to be tested, or prior to registration of the Certificate of Installation.

The HERS Provider shall "close" any "open" group within 6 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 HERS Provider shall notify the builder that the group has been "closed," and require that a sample dwelling shall be selected for field verification and diagnostic testing by a HERS Rater if field verification has not yet been conducted on a sample dwelling entered in the group.

7.2.2 Additional Guidance for Group Sampling Procedures and Documentation

7.2.2.1 Certificate of Verification Documentation for Not-tested Dwellings in a Sample Group

When a dwelling complies with a HERS verification as one of the "not-tested" dwellings in a sample group, a Certificate of Verification document for that feature for that dwelling should be created that does not include actual verification results data, but only includes the following items:

a. **Certificate of Verification Header** for the applicable compliance document for the HERS verification protocol for the HERS feature that was verified in the "tested" dwelling by the HERS Rater.
b. **Certificate of Verification Footer** for the applicable compliance document for the HERS verification protocol for the HERS feature that was verified in the "tested" dwelling by the HERS Rater.
c. **Certificate of Verification Signature block** for the applicable compliance document for the HERS verification protocol for the HERS feature that was verified in the "tested" dwelling by the HERS Rater.
d. **Water mark** that indicates the dwelling passed as a "not-tested" dwelling in the sample group.

The process used by the Data Registry for generating the Certificate of Verification document for not-tested dwellings in a sample group should include the following:

a. Use the same URI call to the Report Generator that is used for the tested version of the CF3R compliance document for that feature in the sample group. When the compliance document type is a variant series type, it is necessary to include the variant letter (e.g. the "a" in CF3RMCH20**a**H) used for the tested dwelling doc. The RG uses the docToken (e.g. CF3RMCH20aH) to pick the document header info.
b. Send XML to the RG that includes a value = "NotTested" in the signature block field named "SampleGroupTestStatus". The RG reads the value of <comp:responsiblePerson5_SampleGroupTestStatus>NotTested</comp:responsiblePerson5_SampleGroupTestStatus> and validates using the CF3RFeatureNotTested schema (CF3RFeatureNotTestedH.xsd). There is no need to include in the XML, any data other than that needed for the specific project or dwelling unit name, location, enforcement agency, and permit information that should be displayed in the header of the completed compliance document. The remainder of the signature block and footer data is expected to be appended/overlaid after the PDF format document has been produced by the RG and transmitted to the Data Registry as described in Section 4.4, with the exception that the signatures provided for the "tested" dwelling may be automatically used for the "not-tested" dwelling(s) as well. Registration of not-tested dwelling documents may be performed automatically in conjunction with the registration of the tested dwelling document for the

group. The documentation author and responsible person are not required to provide additional signing actions for the not-tested dwelling unit documents. Additionally, the Data Registry should ensure that each dwelling document in the sample group is given a unique registration number.

7.2.2.2 Group Sampling Rules Applicable to Specific 2016 Compliance Documents and HERS Features

Additional guidance for specific 2016 compliance documentation for group sampling, and guidance for specific HERS verification features for group sampling is provided in Table 7-1.

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF1R-NCB-01-E	Prescriptive Certificate of Compliance	Residential Newly Constructed Buildings and Additions Greater Than 1000 ft^2 (Prescriptive)	sampling n/a
CF1R-ADD-01-E	Prescriptive Certificate of Compliance	Residential Building Additions less than 1,000 ft^2 (Prescriptive)	sampling n/a
CF1R-ALT-01-E	Prescriptive Certificate of Compliance	Residential Building Alterations (Prescriptive)	sampling n/a
CF1R-ALT-02-E	Prescriptive Certificate of Compliance	HVAC Alterations	sampling n/a
CF1R-ENV-02-E	Prescriptive Certificate of Compliance	Area Weighted Average Calculation Worksheet	sampling n/a
CF1R-ENV-03-E	Prescriptive Certificate of Compliance	Solar Heat Gain Coefficient (SHGC) Worksheet	sampling n/a
CF1R-ENV-04-E	Prescriptive Certificate of Compliance	Cool Roof and SRI Worksheet	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF1R-PLB-01-E	Prescriptive Certificate of Compliance	Hydronic Heating System Worksheet	sampling n/a
CF1R-SRA-01-E	Prescriptive Certificate of Compliance	Solar Ready Buildings	sampling n/a
CF1R-SRA-02-E	Prescriptive Certificate of Compliance	Minimum Solar Zone Area Worksheet	sampling n/a
CF1R-STH-01-E	Prescriptive Certificate of Compliance	OG 300 Solar Water Heating System Worksheet	sampling n/a
CF1R-STH-02-E	Prescriptive Certificate of Compliance	OG 100 Solar Water Heating System Worksheet (California F-Chart)	sampling n/a
CF2R-ENV-01-E	Certificate of Installation	Fenestration Installation	sampling n/a
CF2R-ENV-03-E	Certificate of Installation	Insulation Installation	sampling n/a
CF2R-ENV-04-E	Certificate of Installation	Roofing; Cool Roofs	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-ENV-20a-H	Certificate of Installation	Building Envelope Air Leakage Single-Point Test with Manual Meter	**Envelope Leakage Feature** When the CF1R indicates requirement for Envelope Leakage HERS verification for the dwelling, compliance may be demonstrated using any one of the applicable variants (a, b, c, d, e). The same variant does not need to be used in all dwellings in a sample group, thus any combination of ENV-20 variants can be used to qualify to be in the same sample group for envelope leakage credit features.
CF3R-ENV-20a-H	Certificate of Verification		
CF2R-ENV-20b-H	Certificate of Installation	Building Envelope Air Leakage Single-Point Test with Automatic Meter	
CF3R-ENV-20b-H	Certificate of Verification		
CF2R-ENV-20c-H	Certificate of Installation	Building Envelope Air Leakage Multi-Point Test	
CF3R-ENV-20c-H	Certificate of Verification		
CF2R-ENV-20d-H	Certificate of Installation	Building Envelope Air Leakage Repeated Single Point with Manual Meter	
CF3R-ENV-20d-H	Certificate of Verification		
CF2R-ENV-20e-H	Certificate of Installation	Building Envelope Air Leakage Repeated Single Point with Automatic Meter	
CF3R-ENV-20e-H	Certificate of Verification		

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF3R-ENV-21-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Framing Stage for Batt, Loose Fill, and SPF	**QII Feature** When the CF1R indicates requirement for QII HERS verification for the dwelling, compliance shall be demonstrated using all of the QII HERS verification compliance docs that are applicable to the dwelling (CF3R-ENV-21, 22, 23, 24). The same mix of QII compliance docs need not be used in all dwellings in a sample group, thus any combination of QII compliance docs (CF3R-ENV-21, 22, 23, 24) can be used to qualify to be in the same sample group for QII features.
CF3R-ENV-22-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Ceiling/Roof Deck	
CF3R-ENV-23-H	Certificate of Verification	Quality Insulation Installation (QII) Insulation Stage	
CF3R-ENV-24-H	Certificate of Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Framing Stage for SIP and ICF	
CF3R-EXC-20-H	Certificate of Verification	HERS Verification for Existing Conditions for performance compliance for alterations. Required as prerequisite to registration of a CF1R-PRF for an altered dwelling.	sampling n/a
CF2R-LTG-01-E	Certificate of Installation	Lighting - Single Family Dwellings	sampling n/a
CF2R-LTG-02-E	Certificate of Installation	Lighting - Multifamily Dwellings	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-01a-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Performance Compliance	sampling n/a
CF2R-MCH-01b-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Prescriptive Alterations	sampling n/a
CF2R-MCH-01c-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Prescriptive Newly Constructed Buildings	sampling n/a
CF2R-MCH-02-E	Certificate of Installation	Whole House Fan	sampling n/a
CF2R-MCH-04-E	Certificate of Installation	Evaporative Coolers	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-20a-H	Certificate of Installation	Duct Leakage Measurement New System	**Duct Leakage Feature** When the MCH-01 indicates requirement for MCH-20 for HERS verification for duct leakage in the dwelling, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, b, c, d, e). The same variant does not need to be used in all dwellings in a sample group, thus any combination of MCH-20 variants can be used to qualify to be in the same sample group. When MCH-20e is used for compliance, the MCH-20-documented dwelling shall be verified by a HERS Rater (cannot comply as "not tested" dwelling in a sample group), additionally the MCH-20e-documented dwelling cannot be used to represent the "tested" dwelling for duct leakage compliance for the sample group.
CF3R-MCH-20a-H	Certificate of Verification		
CF2R-MCH-20b-H	Certificate of Installation	Duct Leakage Measurement Low Leakage Ducts in Conditioned Space Compliance Credit;	
CF3R-MCH-20b-H	Certificate of Verification		
CF2R-MCH-20c-H	Certificate of Installation	Duct Leakage Measurement Low Leakage Air-Handling Units	
CF3R-MCH-20c-H	Certificate of Verification		
CF2R-MCH-20d-H	Certificate of Installation	Duct Leakage Measurement Altered (Existing) System	
CF3R-MCH-20d-H	Certificate of Verification		
CF2R-MCH-20e-H	Certificate of Installation	Duct Leakage Measurement Sealing of All Accessible Leaks	
CF3R-MCH-20e-H	Certificate of Verification		

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-21-H	Certificate of Installation	Duct Location Verification	**Duct Location Feature** When the MCH-01 indicates requirement for MCH-21 for HERS verification for duct location in the dwelling, qualification for inclusion in a sample group may be demonstrated using MCH-21 regardless of which duct location verification protocol is reported on the MCH-21. The same duct location verification protocol does not need to be used in all dwellings in a sample group, thus any combination of MCH-21 verifications can be used to qualify to be in the same sample group.
CF3R-MCH-21-H	Certificate of Verification		
CF2R-MCH-22a-H	Certificate of Installation	Forced Air System Fan Efficacy (Watt/cfm) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	**Fan Efficacy Feature** When the MCH-01 indicates requirement for MCH-22 for HERS verification for fan efficacy in the dwelling, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, b), or by use of a MCH-28 when indicated on the MCH-01. The same variant does not need to be used in all dwellings in a sample group, thus any combination of MCH-22 variants or MCH-28 alternatives can be used to qualify to be in the same sample group for the fan efficacy feature.
CF3R-MCH-22a-H	Certificate of Verification		
CF2R-MCH-22b-H	Certificate of Installation	Forced Air System Fan Efficacy (Watt/cfm) Zonally Controlled Systems in Every Zonal Control Mode	
CF3R-MCH-22b-H	Certificate of Verification		

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-23a-H	Certificate of Installation	Forced Air System Airflow Rate (cfm/ton) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	**Airflow Rate Feature** When the MCH-01 indicates requirement for MCH-23 for HERS verification for system airflow rate in the dwelling, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, b, c), or by use of a MCH-28 when indicated on the MCH-01. The same MCH-23 variant does not need to be used in all dwellings in a sample group, thus any combination of MCH-23 variants or MCH-28 alternatives can be used to qualify to be in the same sample group for the airflow rate verification feature. When MCH-23c is used for compliance, the MCH-23-documented dwelling shall be verified by a HERS Rater (cannot comply as "not tested" dwelling in a sample group), additionally the MCH-23c-documented dwelling cannot be used to represent the "tested" dwelling for airflow rate compliance for the sample group.
CF3R-MCH-23a-H	Certificate of Verification		
CF2R-MCH-23b-H	Certificate of Verification	Forced Air System Airflow Rate (cfm/ton) Zonally Controlled Systems in Every Zonal Control Mode	
CF3R-MCH-23b-H	Certificate of Verification		
CF2R-MCH-23c-H	Certificate of Verification	Forced Air System Airflow Rate Alternative Compliance (best-that-I-can-do)	
CF3R-MCH-23c-H	Certificate of Verification		
CF2R-MCH-23d-H	Certificate of Installation	Forced Air System Airflow Rate Measurement Only (CFM)	
CF3R-MCH-23d-H	Certificate of Verification	Single Zone Systems or Zonally Controlled Systems with All Zones Calling	

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-24a-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	MCH-24 does not document an applicable sampling feature by itself (MCH-24 is used for completing some MCH-27 docs). Use of a MCH-24 doc is not significant when determining qualification for HERS Sample groups.
CF3R-MCH-24a-H	Certificate of Verification	Single-Point Test with Manual Meter	
CF2R-MCH-24b-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24b-H	Certificate of Verification	Single-Point Test with Automatic Meter	
CF2R-MCH-24c-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24c-H	Certificate of Verification	Multi-Point Test	
CF2R-MCH-24d-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24d-H	Certificate of Verification	Repeated Single Point with Manual Meter	
CF2R-MCH-24e-H	Certificate of Installation	Building Envelope Air Leakage Worksheet	
CF3R-MCH-24e-H	Certificate of Verification	Repeated Single Point with Automatic Meter	

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-25a-H	Certificate of Installation	Refrigerant Charge Verification Superheat Method (Standard Charge Procedure)	**Refrigerant Charge Feature** When the MCH-01 indicates requirement for MCH-25 for HERS verification for refrigerant Charge verification for the dwelling, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, b, c, d, e, f). The same variant does not need to be used in all dwellings in a sample group, thus any combination of MCH-25 variants can be used to qualify to be in the same sample group. When CF2R-MCH-25c is used for installation compliance, the MCH-25-documented dwelling shall be verified by a HERS Rater (cannot comply as "not tested" dwelling in a sample group), additionally the installer's MCH-25c-documented dwelling cannot be used to represent the "tested" dwelling for Refrigerant Charge compliance for the sample group. When MCH-25f is used by the installer, there is no required HERS verification for the system. These systems are eligible to be included in a sample group for Refrigerant Charge verification features, but these systems cannot be used to represent the "tested" dwelling for Refrigerant Charge compliance for the sample group.
CF3R-MCH-25a-H	Certificate of Verification		
CF2R-MCH-25b-H	Certificate of Installation	Refrigerant Charge Verification Subcooling Method (Standard Charge Procedure)	
CF3R-MCH-25b-H	Certificate of Verification		
CF2R-MCH-25c-H	Certificate of Installation	Refrigerant Charge Verification Weigh-in Charging Procedure	
CF3R-MCH-25c-H	Certificate of Verification		
CF2R-MCH-25d-H	Certificate of Installation	Refrigerant Charge Verification - Fault Indicator Display (FID) (embedded in the CF2R MCH-25a,b,e)	
CF3R-MCH-25d-H	Certificate of Verification	Refrigerant Charge Verification Fault Indicator Display (FID) (standalone CF3R-MCH-25d)	
CF2R-MCH-25e-H	Certificate of Installation	Refrigerant Charge Verification Winter Setup	
CF3R-MCH-25e-H	Certificate of Verification		
CF2R-MCH-25f-E	Certificate of Installation	Refrigerant Charge Verification - Packaged System Manufacturer Refrigerant Charge Certification (CF2R only for the f variant)	

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-26-H	Certificate of Installation	Rated Space Conditioning System Equipment Verification	Rated Space Conditioning System Feature When the MCH-01 indicates requirement for MCH-26 for HERS verification for space conditioning system rating in the dwelling, qualification for inclusion in a sample group may be demonstrated using MCH-26 regardless of which rating verification protocol is reported on the MCH-26. The same space conditioning system equipment verification protocol does not need to be used in all dwellings in a sample group, thus any combination of MCH-26 verifications can be used to qualify to be in the same sample group.
CF3R-MCH-26-H	Certificate of Verification		

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-27a-H	Certificate of Installation	Mechanical Ventilation Continuous Whole-Building Mechanical Ventilation Airflow Fan Vent Rate Method	**IAQ Mechanical Ventilation Feature** When MCH-27 for HERS verification for Mechanical Ventilation Airflow Rate is required for the dwelling, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, b, c, d). The same variant does not need to be used in all dwellings in a sample group, thus any combination of MCH-27 variants can be used to qualify to be in the same sample group
CF3R-MCH-27a-H	Certificate of Verification		
CF2R-MCH-27b-H	Certificate of Installation	Mechanical Ventilation Continuous Whole-Building Mechanical Ventilation Airflow Total Vent Rate Method	
CF3R-MCH-27b-H	Certificate of Verification		
CF2R-MCH-27c-H	Certificate of Installation	Mechanical Ventilation Intermittent Whole-Building Mechanical Ventilation Airflow Fan Vent Rate Method	
CF3R-MCH-27c-H	Certificate of Verification		
CF2R-MCH-27d-H	Certificate of Installation	Mechanical Ventilation Intermittent Whole-Building Mechanical Ventilation Airflow Total Vent Rate Method	
CF3R-MCH-27d-H	Certificate of Verification		
CF2R-MCH-28-H	Certificate of Installation	Return Duct And Filter Grille Design According to Tables 150.0-B or C	**Return Duct Design Alternative to Airflow Rate and Fan Efficacy verification** When indicated on MCH-01, a MCH-28 shall be used as an alternative to compliance with airflow rate (MCH-23) and fan efficacy (MCH-22) HERS features, and the system qualifies for inclusion in a sample group for airflow rate and Fan Efficacy Features.
CF3R-MCH-28-H	Certificate of Verification		

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-MCH-29-H	Certificate of Installation	Supply Duct Surface Area and R-Value; Buried Ducts; Deeply Buried Ducts	**Duct Design Features** When the MCH-01 indicates requirement for MCH-29 for HERS verification for Duct Surface Area and R-Value and Buried Ducts Features in the dwelling, qualification for inclusion in a sample group may be demonstrated using MCH-29 regardless of which verification protocol is reported on the MCH-29. The same duct verification protocol does not need to be used in all dwellings in a sample group, thus any combination of MCH-29 verifications can be used to qualify to be in the same sample group.
CF3R-MCH-29-H	Certificate of Verification		
CF2R-MCH-30-H	Certificate of Installation	Central Fan Ventilation Cooling Systems compliance credit	When the MCH-01 indicates requirement for MCH-30 for verification of central fan ventilation cooling systems (VCS) in the dwelling, qualification for inclusion in a sample group may be demonstrated using MCH-30 regardless of which type of VCS is documented on the MCH-30. The same VCS equipment verification protocol does not need to be used in all dwellings in a sample group, thus any combination of MCH-30 verifications can be used to qualify to be in the same sample group.
CF3R-MCH-30-H	Certificate of Verification		
CF2R-PLB-01-E	Certificate of Installation	Multifamily Central Hot Water System Distribution - NON-HERS	sampling n/a
CF2R-PLB-02-E	Certificate of Installation	Single Dwelling Unit Hot Water System Distribution - NON-HERS	sampling n/a
CF2R-PLB-03-E	Certificate of Installation	Pool and Spa Systems	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-PLB-21-H	Certificate of Installation	HERS - Multifamily Central Hot Water System Distribution Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units	**Multifamily DHW Feature** When the CF1R indicates requirement for PLB-21 for HERS verification for multifamily DHW in the dwelling, qualification for inclusion in a sample group may be demonstrated using PLB-21 regardless of which verification protocol is reported on the PLB-21. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-21 verifications can be used to qualify to be in the same sample group.
CF3R-PLB-21-H	Certificate of Installation		
CF2R-PLB-22-H	Certificate of Installation	HERS - Single Dwelling Unit Hot Water System Distribution	**SFD DHW Feature** When the CF1R indicates requirement for PLB-22 for HERS verification for single family dwelling DHW feature, qualification for inclusion in a sample group may be demonstrated using PLB-22 regardless of which verification protocol is reported on the PLB-22. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-22 verifications can be used to qualify to be in the same sample group.
CF3R-PLB-22-H	Certificate of Verification		
CF2R-SPV-01a-E	Certificate of Installation	PV Systems - Photovoltaic Systems Compliance Credits	sampling n/a
CF2R-SPV-01b-E	Certificate of Installation	PV Systems - Exception to Solar Ready Area requirements	sampling n/a
CF2R-SPV-01c-E	Certificate of Installation	PV Systems - PV Compliance Credits + Exceptions to SRA requirements	sampling n/a

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
CF2R-STH-01-E	Certificate of Installation	Solar Water Heating Systems	sampling n/a
NRCV-MCH-04a-H	Certificate of Verification	Nonresidential Duct Leakage Measurement New System	**Nonresidential Duct Leakage Feature** When NRCV-MCH-04 for HERS verification for duct leakage is required for system compliance, qualification for inclusion in a sample group may be demonstrated using any one of the applicable variants (a, c, d, e). The same variant does not need to be used in all buildings in a sample group, thus any combination of NRCV-MCH-04 variants can be used to qualify to be in the same sample group. When NRCV-MCH-04e is used for compliance, the NRCV-MCH-04-documented system shall be verified by a HERS Rater (cannot comply as "not tested" system in a sample group), additionally the NRCV-MCH-04e-documented system cannot be used to represent the "tested" system for duct leakage compliance for the sample group.
NRCV-MCH-04c-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Low Leakage Air-Handling Units	
NRCV-MCH-04d-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Altered (Existing) System	
NRCV-MCH-04e-H	Certificate of Verification	Nonresidential Duct Leakage Measurement Sealing of All Accessible Leaks	

Table 7-1. Group Sampling Rules Applicable to 2016 Compliance Documents and HERS Features

Document Number	Document Type	Document Description	Group Sampling Rules
NRCV-PLB-21-H	Certificate of Verification	Nonresidential HERS - High Rise Multifamily Central Hot Water System Distribution Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units;	**Nonresidential Multifamily DHW Feature** When the NRCC indicates requirement for HERS verification for multifamily DHW in the dwelling, qualification for inclusion in a sample group may be demonstrated using PLB-21 regardless of which verification protocol is reported on the PLB-21. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-21 verifications can be used to qualify to be in the same sample group.
NRCV-PLB-22-H	Certificate of Verification	Nonresidential HERS - High Rise Single Dwelling Unit Hot Water System Distribution	**Nonresidential SFD DHW Feature** When the NRCC indicates requirement for HERS verification for single family dwelling DHW feature, qualification for inclusion in a sample group may be demonstrated using PLB-22 regardless of which verification protocol is reported on the PLB-22. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-22 verifications can be used to qualify to be in the same sample group.

Appendix A
Compliance Document Design Files: Graphical Layouts, User Instructions, Data Field definitions, and Calculations

Note: At the end of Appendix A the contents of 2016-CF2R-MCH-01b-SpaceConditioningSystem-PrescriptiveAlterations.docx (prescriptive alterations to space conditioning systems) is displayed for information purposes only. For information for implementation of the MCH-01b document design, refer to the current version of the file maintained in the applicable Energy Commission document design file repository at the following URL.

https://cecbees.unfuddle.com/svn/cecbees_cecrescompliancedocdesignstwentysixteen/

2016-CF1R-ADD-01-E-PrescriptiveAdditionsBuilding.docx

2016-CF1R-ALT-01-E-PrescriptiveAlterationsBuilding.docx
2016-CF1R-ALT-02-E-PrescriptiveAlterationsHVAC.docx
2016-CF1R-ENV-02-E-AreaWeightedAverageWorkSheet.docx
2016-CF1R-ENV-03-E-ShgcWorkSheet.docx
2016-CF1R-ENV-04-E-CoolRoofAndSRIWorksheet.docx
2016-CF1R-NCB-01-E-PrescriptiveNewlyConstructedBuilding.docx
2016-CF1R-PLB-01-E-HydronicHeatingSystemWorksheet.docx
2016-CF1R-SRA-01-E-SolarReadyBuildings.docx
2016-CF1R-SRA-02-E-MinimumSolarZoneAreaWorksheet.docx
2016-CF1R-STH-01-E-OG300 Solar Water Heating Systems Worksheet.docx
2016-CF1R-STH-02-E-OG100 Solar Water Heating Systems Worksheet.docx
2016-CF2R-ENV-01-FenestrationInstallation.docx
2016-CF2R-ENV-03-InsulationInstallation.docx
2016-CF2R-ENV-04-Roofing-RadiantBarrier.docx
2016-CF2R-ENV-20a-BuildingEnvelopeAirLeakage-SinglePointTest-Manual Meter.docx
2016-CF2R-ENV-20b-BuildingEnvelopeAirLeakage-SinglePointTest-AutomaticMeter.docx
2016-CF2R-ENV-20c-BuildingEnvelopeAirLeakage-MultiPointTest.docx
2016-CF2R-ENV-20d-BuildingEnvelopeAirLeakage-RepeatedSinglePointTest-ManualMeter.docx
2016-CF2R-ENV-20e-BuildingEnvelopeAirLeakage-RepeatedSinglePointTest-AutomaticMeter.docx
2016-CF2R-LTG-01-E-Lighting–SingleFamilyDwellings.docx
2016-CF2R-LTG-02-E-Lighting–MultiFamilyDwellings.docx
2016-CF2R-MCH-01a-SpaceConditioningSystem-Performance.docx
2016-CF2R-MCH-01b-SpaceConditioningSystem-PrescriptiveAlterations.docx
2016-CF2R-MCH-01c-SpaceConditioningSystem-PrescriptiveNCB.docx
2016-CF2R-MCH-02-WholeHouseFan.docx
2016-CF2R-MCH-04-EvaporativeCoolers.docx
2016-CF2R-MCH-20a-DuctLeakageTest-NewConst.docx
2016-CF2R-MCH-20b-DuctLeakage-LLDCS.docx
2016-CF2R-MCH-20c-DuctLeakage-LLAHU.docx

2016-CF2R-MCH-20d-DuctLeakageTest-ExistingConst.docx
2016-CF2R-MCH-20e-DuctleakageTest-SealingAccesibleLeaks.docx
2016-CF2R-MCH-21-DuctLocation.docx
2016-CF2R-MCH-22a-FanEfficacy-AllZonesCallingOnly.docx
2016-CF2R-MCH-22b-FanEfficacy-EveryZonalControlMode.docx
2016-CF2R-MCH-23a-AirflowRate-AllZonesCallingOnly.docx
2016-CF2R-MCH-23b-AirflowRate-EveryZonalControlMode.docx
2016-CF2R-MCH-23c-AirflowRate-BestThatIcanDo.docx
2016-CF2R-MCH-23d-AirflowRate-MeasurementOnly-AllZonesCallingOnly.docx
2016-CF2R-MCH-24a-BuildingEnvelopeAirLeakageWorksheet-SinglePointTest-Manual Meter.docx
2016-CF2R-MCH-24b-BuildingEnvelopeAirLeakageWorksheet-SinglePointTest-AutomaticMeter.docx
2016-CF2R-MCH-24c-BuildingEnvelopeAirLeakageWorksheet-MultiPointTest.docx
2016-CF2R-MCH-24d-BuildingEnvelopeAirLeakageWorksheet-RepeatedSinglePointTest-ManualMeter.docx
2016-CF2R-MCH-24e-BuildingEnvelopeAirLeakageWorksheet-RepeatedSinglePointTest-AutomaticMeter.docx
2016-CF2R-MCH-25a-RefrigerantCharge-Superheat.docx
2016-CF2R-MCH-25b-RefrigerantCharge-Subcooling.docx
2016-CF2R-MCH-25c-RefrigerantCharge-WeighIn.docx
2016-CF2R-MCH-25e-RefrigerantCharge-WinterSetup.docx
2016-CF2R-MCH-25f-RefrigerantCharge-PackagedSystemManufacturerCert.docx
2016-CF2R-MCH-26-RatedSystemVerification.docx
2016-CF2R-MCH-27a-ContinuousMechVent-FanVentRateMethod.docx
2016-CF2R-MCH-27b-ContinuousMechVent-TotalVentRateMethod.docx
2016-CF2R-MCH-27c-IntermittentMechVent-FanVentRateMethod.docx
2016-CF2R-MCH-27d-IntermittentMechVent-TotalVentRateMethod.docx
2016-CF2R-MCH-28-ReturnDuctAndFilterGrilleDesign-Table150.0-BorC.docx
2016-CF2R-MCH-29-SupplyDuctSurfaceAreaBuriedDucts.docx
2016-CF2R-MCH-30-VentilationCooling.docx
2016-CF2R-PLB-01-NonHERS-MultifamilyCentralHotWaterSystemDistribution.docx
2016-CF2R-PLB-02-NonHERS-SingleDwellingUnitHotWaterSystemDistribution.docx
2016-CF2R-PLB-03-PoolAndSpaHeatingSystems.docx
2016-CF2R-PLB-21-HERS-MultifamilyCentralHotWaterSystemDistribution.docx
2016-CF2R-PLB-22-HERS-SingleDwellingUnitHotWaterSystemDistribution.docx
2016-CF2R-SPV-01a-PVSystems-ComplianceCreditts.docx
2016-CF2R-SPV-01b-PVSystemsExceptionsToSRA_Requirements.docx
2016-CF2R-SPV-01c-PvComplianceCreditsAndExemptionsToSRA.docx
2016-CF2R-STH-01-SolarWaterHeatingSystems.docx
2016-CF3R-ENV-20a-BuildingEnvelopeAirLeakage-SinglePointTest-Manual Meter.docx
2016-CF3R-ENV-20b-BuildingEnvelopeAirLeakage-SinglePointTest-AutomaticMeter.docx
2016-CF3R-ENV-20c-BuildingEnvelopeAirLeakage-MultiPointTest.docx
2016-CF3R-ENV-20d-BuildingEnvelopeAirLeakage-RepeatedSinglePointTest-ManualMeter.docx
2016-CF3R-ENV-20e-BuildingEnvelopeAirLeakage-RepeatedSinglePointTest-AutomaticMeter.docx
2016-CF3R-ENV-21-HERS-QII-FramingStage-Batt,Loose,Fill,SPF.docx
2016-CF3R-ENV-22-CeilingAirBarrier.docx
2016-CF3R-ENV-23-HERS-QII-InsulationStage.docx
2016-CF3R-ENV-24-HERS-QII-FramingStage-SIP,ICF.docx

2016-CF3R-MCH-20a-DuctLeakageTest-NewConst.docx
2016-CF3R-MCH-20b-DuctLeakage-LLDCS.docx
2016-CF3R-MCH-20c-DuctLeakage-LLAHU.docx
2016-CF3R-MCH-20d-DuctLeakageTest-ExistingConst.docx
2016-CF3R-MCH-20e-DuctleakageTest-SealingAccesibleLeaks.docx
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2016-CF3R-MCH-22b-FanEfficacy-EveryZonalControlMode.docx
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2016-CF3R-MCH-23b-AirflowRate-EveryZonalControlMode.docx
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2016-CF3R-MCH-24e-BuildingEnvelopeAirLeakageWorksheet-RepeatedSinglePointTest-AutomaticMeter.docx
2016-CF3R-MCH-25a-RefrigerantCharge-Superheat.docx
2016-CF3R-MCH-25b-RefrigerantCharge-Subcooling.docx
2016-CF3R-MCH-25c-RefrigerantCharge-WeighinObservation.docx
2016-CF3R-MCH-25d-RefrigerantCharge-FID.docx
2016-CF3R-MCH-25e-RefrigerantCharge-WinterSetUp.docx
2016-CF3R-MCH-26-RatedSystemVerification.docx
2016-CF3R-MCH-27a-ContinuousMechVent-FanVentRateMethod.docx
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2016-CF3R-PLB-22-HERS-SingleDwellingUnitHotWaterSystemDistribution.docx
2016-NRCV-MCH-04a-DuctLeakageTest-NewConst.docx
2016-NRCV-MCH-04c-DuctLeakage-LLAHU.docx
2016-NRCV-MCH-04d-DuctLeakageTest-ExistingConst.docx
2016-NRCV-MCH-04e-DuctleakageTest-SealingAccesibleLeaks.docx
2016-NRCV-PLB-21-HERS-HighRiseMultifamilyCentralHotWaterSystemDistribution.docx
2016-NRCV-PLB-22-HERS-HighRiseSingleDwellingUnitHotWaterSystemDistribution.docx

The contents of the file named 2016-CF2R-MCH-01b-SpaceConditioningSystem-PrescriptiveAlterations.docx follows.

STATE OF CALIFORNIA

SPACE CONDITIONING SYSTEMS DUCTS AND FANS

CEC-CF2R-MCH-01-H (Revised MMYY)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 1 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

A. General Information

01	Dwelling Unit Name		02	Climate Zone	
03	Dwelling Unit Total Conditioned Floor Area (ft^2)		04	Number of Space Conditioning Systems in this Dwelling Unit	
05	Certificate of Compliance Type		06	Method Used to Calculate HVAC Loads	
07	Calculated Dwelling Unit Sensible Cooling Load (Btuh)		08	Calculated Dwelling Unit Heating Load (Btuh)	
09	Dwelling Unit Number of Bedrooms				

CF2R-MCH-01b – Prescriptive Alterations - Space Conditioning Systems Ducts and Fans

B. Space Conditioning (SC) System Information

01	02	03	04	05	06	07	08	09	10
SC System Identification or Name	SC System Location or Area Served	CFA served by this SC System (ft^2)	Is the SC system a ducted system?	Installing a refrigerant containing component?	Installing new SC System components?	Installing more than 40 feet of ducts?	Installing entirely new duct system?	Installing entirely new SC system?	Alteration Type

C. Space Conditioning (SC) System Alterations Compliance Information

01	02	03	04	05	06	07	08	09	10	11	12	13
System Identification or Name	Heating System Type	Altered Heating Component	Heating Efficiency Type	Heating Minimum Efficiency Value	Cooling System Type	Altered Cooling Components	Cooling Efficiency Type	Cooling Minimum Efficiency Value	Required Thermostat Type	New or Replaced Duct Length	New Duct R-Value	Central Fan Integrated (CFI) Ventilation System Status

For information and data collection only. Not valid unless registered with a HERS provider.

Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised MM/YY) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 2 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

D. Installed Heating Equipment Information

01	02	03	04	05	06	07
System Identification or Name	Heating Efficiency Type	Heating Efficiency Value	Heating Unit Manufacturer	Heating Unit Model Number	Heating Unit Serial Number	Rated Heating Capacity, Output (Btuh)

Notes:

E. Installed Cooling Equipment Information

01	02	03	04	05	06	07	08
System Identification or Name	Cooling Efficiency Type	Cooling Efficiency Value	Condenser or Package Unit Manufacturer	Condenser or Package Unit Model Number	Condenser or Package Unit Serial Number	System Rated Cooling Capacity at Design Conditions (Btuh)	Condenser Rated Nominal Capacity (ton)

Notes:

F. Extension of Existing Duct System, Greater Than 40 Feet

01	02
System Identification or Name	New Duct R-Value

For information and data collection only. Not valid until registered with a HERS provider.

Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised MM/YY)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 3 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

G. Installed Duct System Information

01	02	03	04	05	06	07	08
SC System Identification or Name	SC System Location or Area Served	Supply Duct Location	Supply Duct R-Value	Return Duct Location	Return Duct R-Value	Method of Compliance with Duct and Filter Grille Sizing Req's in 150.0(m)13	Number of Air Filter Devices on System

Notes:

H. Installed Air Filter Device Information

01	02	03	04	05	06	07
SC System Identification or Name	SC System Location or Area Served	Air Filter Identification or Name	Air Filter Device Type	Air Filter Device Location	Determined Design Airflow Rate for Air Filter Device (cfm)	Determined Design Allowable Pressure Drop for Air Filter Device (inch W.C.)

Notes:

I. Air Filter Device Requirements

01	The system shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through the system's thermal conditioning components.
02	The system shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter device(s). The design airflow rate and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter device shall be determined, and all system air filter device locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter device, readily legible, and visible to a person replacing the air filter media, and the air filter devices shall be provided with air filter media that conforms to these determined/labeled maximum allowable clean-filter pressure drop values as rated using AHRI Standard 680.
03	All system air filter devices shall be located and installed in such a manner as to allow access and regular service by the system owner.
04	The system shall be provided with air filter media having a designated efficiency equal to or greater than MERV 6 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50% in the 3.0–10 micron range when tested in accordance with AHRI Standard 680.
05	The system shall be provided with air filter media that has been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that conform to the required efficiency and pressure drop requirements for the air filter device.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

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STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised MMYY)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 4 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

J. HERS Verification Requirements

01	02	03	04	05	06	07	08	09	10
System Identification or Name	SC System Location or Area Served	Exemption From Duct Leakage Requirements	MCH-20 Duct Leakage Test	Exemption from Minimum R-Value for Ducts In Conditioned Space	MCH-21 Ducts Located In Cond Space Verification	MCH-22 AHU Fan Efficacy (W/cfm)	MCH-23 AHU Airflow Rate (cfm/ton)	MCH-25 Refrigerant Charge	MCH-28 Return Duct Design - Table 150.0-B or C

Notes:

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Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised MM/YY) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 5 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

K. Space Conditioning Systems, Ducts and Fans – Mandatory Requirements and Additional Measures Note: Additional mandatory requirements from Section 150.0 that are not listed here may be applicable to some systems. These requirements may be applicable to only newly installed equipment or portions of the system that are altered. Existing equipment may be exempt from these requirements.	
Heating Equipment	
01	Equipment Efficiency: All heating equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.
02	Controls: All unitary heating systems, including heat pumps, must be controlled by a setback thermostat. These thermostats must be capable of allowing the occupant to program the temperature set points for at least four different periods in 24 hours. See Sections 150.0(i), 110.2(b).
03	Sizing: Heating load calculations must be done on portions of the building served by new heating systems to prevent inadvertent undersizing or oversizing. See sections 150.0(h)1 and 2).
04	Furnace Temperature Rise: Central forced-air heating furnace installations must be configured to operate at or below the furnace manufacturer's maximum inlet-to-outlet temperature rise specification. See Section 150.0(h)4.
05	Standby Losses and Pilot Lights: Fan-type central furnaces may not have a continuously burning pilot light. Section 110.5 and Section 110.2(d).
Cooling Equipment	
06	Equipment Efficiency: All cooling equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.
07	Refrigerant Line Insulation: All refrigerant line insulation in split system air conditioners and heat pumps must meet the R-value and protection requirements of Section 150.0(j)2 and 3, and Section 150.0(m)9.
08	Condensing Unit Location: Condensing units shall not be placed within 5 feet of a dryer vent outlet. See Section 150.0(h)3A.
09	Liquid Line Filter Drier: If applicable, a liquid line filter drier shall be installed according to the manufacturer's specifications. Section 150.0(h)3B
10	Sizing: Cooling load calculations must be done on portions of the building served by new cooling systems to prevent inadvertent undersizing or oversizing. See Section 150.0(h)1 and 2.
Air Distribution System Ducts, Plenums and Fans	
11	Insulation: In all cases, unless ducts are enclosed entirely in directly conditioned space, the minimum duct insulation value is R-6. Note that higher values may be required by the prescriptive or performance requirements. See Section 150.0(m)1.
12	Connections and Closures: All installed air-distribution system ducts and plenums must be, sealed and insulated to meet the requirements of CMC Sections 601.0, 602.0, 603.0, 604.0, 605.0 and ANSI/SMACNA-006-2006: Supply-air and return-air ducts and plenums must be insulated to a minimum installed level of R-6.0 or enclosed entirely in directly conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.
Heat Pump Thermostat	
13	A thermostat shall be installed that meets the requirements of Section 110.2(b) and Section 110.2(c).
14	The thermostat shall be installed in accordance with the manufacturers published installation specifications.
15	First stage of heating shall be assigned to heat pump heating.
16	Second stage back up heating shall be set to come on only when the indoor set temperature cannot be met.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

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Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised MMYY)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 6 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Installation documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Documentation Author Company Name:	Date Signed:
Address:	CEA/HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Installation is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction, or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Installation, and attest to the declarations in this statement (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer.
3. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.
4. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met.
5. I will ensure that a registered copy of this Certificate of Installation shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Installation is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Builder/Installer Name:	Responsible Builder/Installer Signature:	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner)	Position With Company (Title):	
Address:	CSLB License:	
City/State/Zip:	Phone	Date Signed:

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Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans - MCH-01	(Page 1 of 5)

CF2R-MCH-01b-E User Instructions

Minimum requirements for prescriptive HVAC installation compliance can be found in Building Energy Efficiency Standards Section 150.2(b)1C.

Completing these documents will require that you have the Reference Appendices for the 2016 Building Energy Efficiency Standards. This document contains the Joint Appendices which are used to determine climate zone and to complete the section for opaque surfaces.
When the term CF2R is used it means the CF2R-MCH-01-H.

Instructions for sections with column numbers and row numbers are given separately.

A. General Information

1 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document.
2 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document.
3 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document. When the project scope includes an addition to an existing building, the value is equal to the sum of the existing conditioned floor area plus the conditioned floor area of the addition. The default value from the CF1R may be overwritten in this document. Overwriting the default value will automatically flag this entry and subject it to additional scrutiny by QA and enforcement personnel.
4 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document. This value may be overwritten in this document but valid discrepancies with the CF1R are uncommon. Overwriting the default value will automatically flag this entry and subject it to additional scrutiny by QA and enforcement personnel.
5 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document.
6 Oversized equipment can result in reduced efficiency and capacity. Entirely new systems (see definition in Section 9.6.9 of the RCM) must be properly sized to match the heating and cooling load of the space that it serves. To do this, heating and cooling load calculations must be performed using an approved calculation methodology. These are listed here. Select the load calculation methodology used for this dwelling unit. If the project consists of a partial replacement of equipment or ducts (change-out) then load calculations are not required. Select N/A. Load calculations are always recommended, especially if the loads of the house have been changed since the original equipment has been installed (reduced via weatherization, other improvements).
7 Enter the total sensible cooling load for the dwelling unit described by this document. For projects involving dwelling units with more than one system, this will be a sum of the loads for the parts of the dwelling unit served by those systems. If the project consists of a partial replacement of equipment or ducts (change-out), then load calculations are not required. Select N/A.
8 Enter the total heating load for the dwelling unit described by this document. For projects involving dwelling units with more than one system, this will be a sum of the loads for the parts of the dwelling unit served by those systems. If the project consists of a partial replacement of equipment or ducts (change-out), then load calculations are not required. Select N/A.
9 Enter the number of bedrooms in the dwelling unit.

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CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans - MCH-01	(Page 2 of 5)

B. Space Conditioning (SC) System Information

1 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document. This value may be overwritten in this document but valid discrepancies with the CF1R are uncommon. Overwriting the default value will automatically flag this entry and subject it to additional scrutiny by QA and enforcement personnel. Revising the CF1R to match is recommended and may be required.

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10 This field is filled out automatically based on the entries in the previous columns.

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CA Building Energy Efficiency Standards - 2016 Residential Compliance <Date>

CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans - MCH-01	(Page 3 of 5)

C. Space Conditioning (SC) System Alterations Compliance Information

1 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document. This value may be overwritten in this document but valid discrepancies with the CF1R are uncommon. Overwriting the default value will automatically flag this entry and subject it to additional scrutiny by QA and enforcement personnel. Revising the CF1R to match is recommended and may be required.

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10 This field is filled out automatically. It is calculated based on entries in previous columns.

11 This field is filled out automatically. It is referenced from the Certificate of Compliance (CF1R), which must be completed prior to this document. This value may be overwritten in this document but valid discrepancies with the CF1R are uncommon. Overwriting the default value will automatically flag this entry and subject it to additional scrutiny by QA and enforcement personnel. Revising the CF1R to match is recommended and may be required.

12 This field is filled out automatically. It is calculated based on entries in previous columns.

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CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans - MCH-01	(Page 4 of 5)

D. Installed Heating Equipment Information

1. This field is filled out automatically. It is referenced from the same row and column in the previous section.
2. This field is filled out automatically. It is referenced from the same row and column in Section C.
3. Enter the certified heating efficiency of the *installed* equipment. This value is verified against the minimum value shown in Section C. The installed efficiency must be greater than or equal to the required minimum efficiency.
4. Enter the name of the *installed* Heating Unit Manufacturer as shown on the equipment nameplate.
5. Enter the name of the *installed* Heating Unit Model Number as shown on the equipment nameplate.
6. Enter the name of the *installed* Heating Unit Serial number as shown on the equipment nameplate.
7. Enter the rated heating capacity (output) of the *installed* Heating Unit in BTUs per hour.

E. Installed Cooling Equipment Information:

1. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
2. This field is filled out automatically. It is referenced from Section C.
3. Enter the certified cooling efficiency of the *installed* equipment that corresponds to the type shown in the previous column. This value is verified against the minimum value shown in Section C. The installed efficiency must be greater than or equal to the required minimum efficiency.
4. Enter the name of the *installed* Condenser or Package Unit Manufacturer as shown on the equipment nameplate.
5. Enter the name of the *installed* Condenser or Package Unit Model Number as shown on the equipment nameplate.
6. Enter the name of the *installed* Condenser or Package Unit Serial Number as shown on the equipment nameplate.
7. Enter the rated sensible cooling capacity at design conditions of the *installed* cooling system in BTUs per hour.
8. Enter the *installed* Condenser Rated Nominal Cooling Capacity in tons. Note that this is based on the condenser, not the coil or air handler. This can usually be determined by the condenser model number.

F. Extension of Existing Duct System, Greater Than 40 Feet

1. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
2. Enter the R-value of the *installed* supply ducts. This value is verified against the minimum value shown in Section C. The installed R-value must be greater than or equal to the required minimum R-value.

G. Installed Duct System information

1. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
2. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
3. Select the choice that best describes the predominant location of the supply ducts for this system.
4. Enter the R-value of the *installed* supply ducts. This value is verified against the minimum value shown in Section C. The installed R-value must be greater than or equal to the required minimum R-value.
5. Select the choice that best describes the predominant location of the return ducts for this system.
6. Enter the R-value of the *installed* return ducts. This value is verified against the minimum value shown in Section C. The installed R-value must be greater than or equal to the required minimum R-value.
7. Pick the appropriate choice. Refer to section 150.0(m)13 of the 2016 Building Energy Efficiency Standards, and Section 4.4 of Chapter 4 of the 2016 Residential Compliance Manual for more information.
8. Specify the number of air filter devices installed in this space conditioning system. Air filter devices installed in completely new systems must be properly sized, as documented in the next section. The value entered here will determine the number of rows needed in the following section.

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CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans - MCH-01	(Page 5 of 5)

H. Installed Air Filter Device Information

1. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
2. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
3. Enter a descriptive name of each air filter device so that it may be distinguished from others in the same system. Examples: FG1, filter2, etc.
4. Select the appropriate type of filter device from the list.
5. Enter a descriptive name of each air filter device so that it may be identified in the home. Examples: master suite, main hallway, at furnace, entry wall, etc.
6. Enter the design flow in CFM of the filter device. The total for all filter devices in a single system should be greater than or equal to the total system design CFM in cooling mode (or heating mode for heat-only systems).
7. Enter the design static pressure drop provided by the filter device manufacturer. This should be consistent with the duct design calculations. Not accounting for higher filter pressure drops will result in poor system airflow characteristics, reduced capacity and reduced efficiency. This may result in not passing field verification.

I. Air Filter Device Requirements

This table is a list of requirements for air filter devices.

J. HERS Verification Requirements

1. This field is filled out automatically. It references previous sections in this document.
2. This field is filled out automatically. It references previous sections in this document.
3. If applicable, select the any of the exemptions listed. Exemptions will be flagged and may subject the system to additional enforcement scrutiny.
4. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
5. If applicable, select the any of the exemptions listed. Exemptions will be flagged and may subject the system to additional enforcement scrutiny.
6. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
7. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
8. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
9. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
10. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.

K. Space Conditioning Systems, Ducts and Fans – Mandatory Requirements and Additional Measures

This table is a list of mandatory measures and additional requirements for space conditioning systems, ducts and fans.

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 1 of 14)

A. **General Information**					
01	Dwelling Unit Name	<<default reference text from CF1R; or allow user override input: text, 15? character maximum>>	02	Climate Zone	<<default reference text from CF1R >>

03	Dwelling Unit Total Conditioned Floor Area (ft^2)	<<numeric: xxxxx;
		if parent is CF1R-PRF, then
		if project scope = Newly Constructed (Addition Alone)
		then prompt user to enter a
		value equal to dwelling unit existing CFA + addition CFA
		else reference the value from CF1R
		
		elseif parent is CF1R-NCB-01, then
		if project scope = New Addition greater than 1,000 ft2
		then prompt user to enter a
		value equal to dwelling unit existing CFA + addition CFA
		elseif project scope = Newly Constructed Building, then
		if building type = Single Family, then
		reference value from CF1R-NCB field A1O
		elseif Building Type= Multifamily, then
		reference value from CF1R-NCB field MO2
		
		elseif parent is CF1R-ADD-01, then
		if building type=Single Family, then
		reference value from CF1R-ADD field JO2
		elseif Building Type= Multifamily, then
		reference value from CF1R-ADD field LO2
		
		elseif parent is CF1R-ALT-01, then
		if building type= Single Family, then
		reference value from CF1R-ALT field GO2
		elseif Building Type= Multifamily, then
		reference value from CF1R-ALT field IO2
		
		allow user to override default and input a value; flag overridden values and report in project status notes field>>
			04	Number of Space Conditioning Systems in this Dwelling Unit	<<integer: xx;
					If parent is CF1R-ALT-02 doc type, then use as default the value referenced from CF1R-ALT-02 Section A; or allow user to override the default and input a new value; flag non-default values and report in project status notes field;
					elseif parent is not CF1R-ALT-02 doc type, then user input the integer value>>

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 2 of 14)

05	Certificate of Compliance Type	<< reference document type property from CF1R: allowed values: performance (CF1R-PRF); or prescriptive additions/alterations (CF1R-ADD/CF1R-ALT); or prescriptive newly constructed (CF1R-NCB)>>	06	method Used to calculate HVAC loads	<<user select from list: "ASHRAE Handbook; "SMACNA Residential Comfort System Installation Standards Manual; "ACCA Manual J "n/a equipment changeout, like-for-like>>
07	Calculated dwelling unit Sensible Cooling Load (Btuh)	<<user entry: integer: xxxxx; or allow selection of value=n/a if value in A06="n/a equipment changeout, like-for-like" >>	08	Calculated Dwelling Unit Heating Load (Btuh)	<<user entry: integer: xxxxx; or allow selection of value=n/a if value in A06="n/a equipment changeout, like-for-like">>
09	Dwelling Unit Number of Bedrooms	<<<<calculated field: integer xx: if CertComplianceType=performance, then use as default the value referenced from CF1R-PRF or allow user to override the default and input a new value; flag non-default values and report in project status notes field; elseif parent is not CF1R-PRF doc type, then user input the integer value xx>>	10	Determination of Mech01 type (this field not visible to user)	<<calculated field: if ""CertComplianceType=performance, then display doc variation MECH01a, ""elseif CertComplianceType=prescriptive additions/alterations, then display doc variation MECH01b, ""elseif CertComplianceType=prescriptive newly constructed, then display doc variation MECH01c (this field not visible to user) >>

CF2R-MCH-01b – Prescriptive Alterations - Space Conditioning Systems Ducts and Fans

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 3 of 14)

B. Space Conditioning (SC) System Information

<< require one row of data to be entered in this table for each of the quantity of space conditioning systems entered in A04>>

01	02	03	04	05	06	07	08	09	10
SC System Identification or Name	SC System Location or Area Served	CFA served by this SC System (ft^2):	Is the SC system a ducted system?	Installing a refrigerant containing component?	Installing new SC System components?	Installing more than 40 feet of ducts?	Installing entirely new duct system?	Installing entirely new SC system?	Alteration Type
<<reference values from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required; do not allow duplicate system names to be used>>	<<reference values from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; allow user to override the default and input a new value; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<< Calculated field: determine the correct result for "alteration type" for entry in this field by the user responses in B04, B05, B06, B07, B08, B09 and use of Logic Table for Determining Alteration Type and HERS Verification Requirements (inserted below this section); constrain user input for fields B04-B09 to allow only the available combinations of responses given in the Logic Table in rows a through s; alteration types are: *Extension of Existing Duct System; *Altered Space Conditioning System; *Entirely New or Complete Replacement Duct System with or without Equipment Changeout; *Entirely New or Complete Replacement Space Conditioning System * No alteration Performed >>

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 4 of 14)

Logic Table for Determining Alteration Type and HERS Verification Requirements (this table not shown on the completed document)

	1	2	3	4	5	6	7	8	9
	Is the altered or installed system a ducted system?	Altering or installing a refrigerant containing component?	Installing new components? (packaged unit, or condensing unit, or cooling/heating coil, or air-handling unit, etc)	Installing more than 40 linear feet of new or replacement ducts?	Is the entire duct system accessible for sealing, and is more than 75% of the duct system new or replaced?	Are all of the system's components and ducts new or replaced? (entirely new system)	alteration type	HERS	notes
a	no	yes	no	no	no	no	Altered space conditioning system	RC	e.g. alteration to refrigerant containing component - mini-split or packaged AC
b	no	yes	yes	no	no	no	Altered space conditioning system	RC	e.g. changeout mini-split system component
c	yes	no	yes	no	no	no	Altered space conditioning system	DctLk	e.g. new hydronic AHU or furnace
d	yes	no	yes	yes	no	no	Altered space conditioning system	DctLk	e.g. new furnace+ duct alteration
e	yes	yes	no	no	no	no	Altered space conditioning system	RC	e.g. alteration to a refrigerant containing component - split system
f	yes	yes	yes	no	no	no	Altered space conditioning system	RC+DctLk	e.g. changeout refrigerant containing components
g	yes	yes	yes	yes	no	no	Altered space conditioning system	RC+DctLk	e.g. changeout refrigerant containing compinent + altered ducts
h	yes	yes	no	yes	no	no	Altered space conditioning system	RC+DctLk	e.g. alteration to refrigerant containing component + altered ducts
i	yes	no	no	yes	yes	no	Entirely new duct system with or without Equipment Changeout	DctLk+ FE/AF or Tbl150.0-B,C	e.g. new duct system without equipment changeout
j	yes	no	yes	yes	yes	no	Entirely new duct system with or without Equipment Changeout	DctLk+ FE/AF or Tbl150.0-B,C	e.g. new furnace+ new duct system
k	yes	yes	no	yes	yes	no	Entirely new duct system with or without Equipment Changeout	RC+DctLk+ FE/AF or Tbl150.0-B,C	e.g. alteration to a refrigerant containing component + new duct system
l	yes	yes	yes	yes	yes	no	Entirely new duct system with or without Equipment Changeout	RC+DctLk+ FE/AF or Tbl150.0-B,C	e.g. changeout refrigerant containing component + new duct system
m	no	no	yes	no	no	yes	Entirely new space conditioning system	none	e.g. new ductless hydronic heating system

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 5 of 14)

n	no	yes	yes	no	no	yes	Entirely new space conditioning system	RC	e.g. new mini-split (weigh-in); or new room packeged AC (factory charged)
o	yes	no	yes	yes	yes	yes	Entirely new space conditioning system	DctLk + FE/AF or Tbl150.0-B,C	e.g. new ducted hydronic heating system
p	yes	yes	yes	yes	yes	yes	Entirely new space conditioning system	RC + DctLk + FE/AF or Tbl150.0-B,C	e.g. new split system
q	yes	no	no	yes	no	no	Extension of an existing duct system	DctLk	e.g. altered ducts
r	no	no	no	no	no	no	System is exempt from the alteration requirements	none	no alteration performed
s	yes	no	no	no	no	no	System is exempt from the alteration requirements	none	no alteration performed

Nomenclature:
RC = Refrigerant Charge Verification (MCH-25)
DctLk = Duct Leakage Test (MCH-20)
FE/AF or Tbl150.0-B,C - Fan Efficacy and Airflow Rate verification (MCH-22; MCH-23) or alternative compliance: (MCH-28)

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 6 of 14)

C. Space Conditioning (SC) System Alterations Compliance Information

<< require one row of data in this table for each of the SC Systems listed in Section B for which Alteration Type in B10 ≠ no alteration performed >>

01	02	03	04	05	06	07	08	09	10	11	12	13
System Identification or Name	Heating System Type	Altered Heating Component	Heating Efficiency Type	Heating Minimum Efficiency Value	Cooling System Type	Altered Cooling Components	Cooling Efficiency Type	Cooling Minimum Efficiency Value	Required Thermostat Type	New or Replaced Duct Length	New Duct R-Value	Central Fan Integrated (CFI) Ventilation System Status
<<reference value from B01>>	<< reference value from CF1R as default; allow user to override the default and pick one from list: 'central gas furnace; 'central split HP; 'central packaged HP 'central large packaged HP 'ductless split HP; 'room HP; 'boiler; 'hydronic; 'combined hydronic; 'hydronic+forced air; 'combined hydronic+forced air; 'hydronic HP; 'hydronic HP+forced air; 'gas wall furnace; 'gas space heater; 'electric; 'N/A (no heating); flag non-default values and report in project status notes field; a revised CF1R may be required >>	<< reference value from CF1R as default; allow user to override the default and pick as many as are applicable from list: 'gas furnace AHU; 'fancoil AHU; 'outdoor condensing unit; 'indoor coil; 'boiler; 'TXV or EXV; 'compressor; 'refrigerant lineset; 'no heating component altered; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; if C03 = no heating component altered, then value =n/a else allow user to override the default and pick one from list: 'AFUE; 'HSPF; 'COP; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; if C03 = no heating component altered, then value =n/a else allow user to override the default to enter value: user enter value: xx.x; default minimum value for AFUE= 0.78; or default minimum value for HSPF= 7.7; allow user to overwrite default value, but flag non-default values and report in project status notes field a revised CF1R may be required>>	<<reference value from CF1R as default; allow user to override the default and pick one from list: 'central split AC; 'central split HP 'central packaged AC ; 'central packaged HP 'central large packaged AC ; ' central large packaged HP 'ductless split AC; 'ductless split HP; 'gas absorption AC 'room AC; 'room HP; 'hydronic HP; 'hydronic HP+forced air 'evaporative - direct 'evaporative - indirect 'evaporative - indirectdirect 'evaporatively cooled condenser 'Ice Storage AC 'no cooling; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<< reference value from CF1R as default; allow user to override the default and pick as many as are applicable from list: 'outdoor condensing unit, 'indoor fancoil AHU, 'indoor coil, 'TXV or EXV, 'Compressor, 'refrigerant lineset, 'no cooling component altered; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; if C07= no cooling component altered, then value =n/a else allow user to override the default;to enter value: user pick from list: 'SEER; 'EER; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<reference value from CF1R as default; if C07= no cooling component altered, then value =n/a else allow user to override the default to enter value: xx.x; default minimum value for SEER=13; allow user to overwrite default value, but flag non-default values and report in project status notes field a revised CF1R may be required >>	<<If alteration type in B10=Extension of Existing Duct System; then display result: 'N/A'; else display result: 'setback'>>	<<calculated field: if B04=no, then display N/A; else reference value from CF1R as default; allow user to override the default and pick one from list: '≤40ft; '>40ft; 'N/A - no ducts replaced; flag non-default values and report in project status notes field; a revised CF1R may be required >>	<<calculated field: if B04=no, then display N/A; elseif C11=N/A, then display N/A; elseif C11≠N/A, then, if A02= C2 1-10, 12, 13, then R-6 ; elseif A02=C2 11, 14-16 then R-8; end>>	<<user pick one from list: 'CFI System 'Not CFI>>

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 7 of 14)

D. Installed Heating Equipment Information

<< If all systems listed in Section C have a value in C03= no heating component altered, then display the section does not apply message; else require one row of data in this table for each of the SC Systems listed in Section C that do not have a value in C03= no heating component altered>>

01	02	03	04	05	06	07
System Identification or Name	Heating Efficiency Type	Heating Efficiency Value	Heating Unit Manufacturer	Heating Unit Model Number	Heating Unit Serial Number	Rated Heating Capacity, Output (Btuh)
<<reference value from B01>>	<<reference value from C04>>	<<user input, numeric, **xx.x**; check value must be ≥ value in C05, to comply; else flag non-compliant value and do not allow this document to be registered >>	<<user input alphanumeric text string max50? characters>>	<<user input alphanumeric text string max50? characters>>	<<user input alphanumeric text string max50? characters>>	<<user input, numeric, **xxxx**>>

Notes:

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 8 of 14)

E. Installed Cooling Equipment Information:

<<if all of the SC Systems listed in Section C have a value in C06=no cooling, then display the section does not apply message; else require one row of data in this table for each of the SC Systems listed in Section C that do not have: a value in C06=no cooling or a value in C07 = no cooling component altered >>

01	02	03	04	05	06	07	08
System Identification or Name	Cooling Efficiency Type	Cooling Efficiency Value	Condenser or Package Unit Manufacturer	Condenser or Package Unit Model Number	Condenser or Package Unit Serial Number	System Rated Cooling Capacity at Design Conditions (Btuh)	Condenser Rated Nominal Capacity (ton)
<<reference value from C01>>	<<reference value from C08>>	<<user input, numeric, xx.x; check value must be ≥ value in C09 to comply; else flag non-compliant value and do not allow this document to be registered >>	<<user input alphanumeric text string max 50? characters>>	<<user input alphanumeric text string max 50? characters>>	<<user input alphanumeric text string max 50 characters>>	<<user input, numeric, xxxxxx>>	<<user input, numeric, x.x>>

Notes:

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 9 of 14)

F. Extension of Existing Duct System, Greater Than 40 Feet

<<if there are no Alteration Types in column B10 equal to "Extension of Existing Duct System" then display the "section does not apply" message; else require one row of data to be entered in this table for each SC System of alteration type in column B10 equal to: "Extension of Existing Duct System">>

01	02	
System Identification or Name	New Duct R-Value	
<<reference value from B01>>	<<user pick from list: R-0.0 R-2.1, R-4.2, R-6, R-8, R-10, R-12; check value: must be ≥ value in C12 to comply; else flag non-compliant value and report in project status notes field; a revised CF1R or revised installation may be required >>	

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 10 of 14)

G. Installed Duct System information

<<if all SC systems in section B have a value in B04=no, then display the section does not apply message;
elsif there are no SC Systems listed in Section B for which a yes response was given in B08, or B09, then display the section does not apply message;
elseif a space conditioning system in Section B has a value in B04=yes, then
if B08=yes, then require one row of data in this table
elsif B09=yes, then require one row of data in this table
end
end>>

01	02	03	04	05	06	07	08
SC System Identification or Name	SC System Location or Area Served	Supply Duct Location	Supply Duct R-Value	Return Duct Location	Return Duct R-Value	Method of Compliance with Duct and Filter Grille Sizing Req's in 150.0(m)13	Number of Air Filter Devices on System

<<reference value from B01>>	<<auto filled from B02>>	<<User pick one from list:
		* conditioned space-entirely,
		* conditioned space - except 12ft,
		* unconditioned attic,
		* unconditioned crawl space,
		* controlled ventilation crawl space
		* unconditioned garage,
		* unconditioned basement,
		* outdoors>>
			<<user pick from list:
			R-0.0
			R-2.1,
			R-4.2,
			R-6,
			R-8,
			R-10,
			R-12;
			check value: must be ≥ value in C12 to comply; else flag non-compliant value and report in project status notes field; a revised CF1R or revised installation may be required >>
				<<User pick one from list:
				* conditioned space-entirely,
				* conditioned space-except 12ft,
				* unconditioned attic,
				* unconditioned crawl space,
				* controlled ventilation crawl space
				* unconditioned garage,
				* unconditioned basement,
				* outdoors>>
					<<user pick from list:
					R-0.0
					R-2.1,
					R-4.2,
					R-6,
					R-8,
					R-10,
					R-12;
					check value: must be ≥ value in C12 to comply; else flag non-compliant value and report in project status notes field; a revised CF1R or revised installation may be required >>
						<<if C06=no cooling, then display result = Heating-only System is Exempt;
						elseif C06=
						*evaporative - direct, or
						*evaporative - indirect, or
						*evaporative - indirect direct, then display result = Evaporative System is Exempt;
						
						elseif B09=yes, then
						if C13=CFI System, then result = HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton);
						
						else,
						user select one from list:
						*HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton); or
						*HERS verified Return Duct Design per Table 150.0-B, C;
						>>
							<<user enter integer value which will determine number or rows per system in next section>>

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 11 of 14)

Notes:

H. Installed Air Filter Device Information

<<if all SC systems in section B have a value in B04=no, then display the section does not apply message;
elsif there are no SC Systems listed in Section B for which a yes response was given in B08, or B09, then display the section does not apply message;
elseif a space conditioning system in Section B has a value in B04=yes, then
if B08=yes, then require one row of data (each) for the quantity of Air filter devices tagged in G08 for all of the System Names in G01
elsif B09=yes, then require one row of data (each) for the quantity of Air filter devices tagged in G08 for all of the System Names in G01
end
end>>

01	02	03	04	05	06	07
SC System Identification or Name	SC System Location or Area Served	Air Filter Identification or Name	Air Filter Device Type	Air Filter Device Location	Determined Design Airflow Rate for Air Filter Device (cfm)	Determined Design Allowable Pressure Drop for Air Filter Device (inch W.C.)
<<reference value from B01>>	<<auto filled from B02>>	<<user input text, maximum 20? characters>>	<<user select fom list: *Filter Grille *Furnace Mounted *Duct Mounted >>	<<user input text, maximum 30 characters>>	<<user enter value numeric; xxx>>	<<user enter value, numeric, x.xx>>

Notes:

I. Air Filter Device Requirements

<<if all SC systems in section B have a value in B04=no, then display the section does not apply message;
elsif there are no SC Systems listed in Section B for which a yes response was given in B08, or B09, then display the section does not apply message,
else display this section>>

01	The system shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through the system's thermal conditioning components.
02	The system shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter device(s). The design airflow rate and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter device shall be determined, and all system air filter device locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter device, readily legible, and visible to a person replacing the air filter media, and the air filter devices shall be provided with air filter media that conforms to these determined/labeled maximum allowable clean-filter pressure drop values as rated using AHRI Standard 680.
03	All system air filter devices shall be located and installed in such a manner as to allow access and regular service by the system owner.
04	The system shall be provided with air filter media having a designated efficiency equal to or greater than MERV6 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50% in the 3.0–10 micron range when tested in accordance with AHRI Standard 680.
05	The system shall be provided with air filter media that has been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that conform to the required efficiency and pressure drop requirements for the air filter device.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 12 of 14)

J. HERS Verification Requirements

<< require one row of data in this table for each of the SC Systems listed in Section C >>

01	02	03	04	05	06	07	08	09	10
			MCH-20		MCH-21	MCH-22	MCH-23	MCH-25	MCH-28
System Identification or Name	SC System Location or Area Served	Exemption From Duct Leakage Requirements	Duct Leakage Test	Exemption from Minimum R-Value for Ducts In Conditioned Space	Ducts Located In Cond Space Verification	AHU Fan Efficacy (W/cfm)	AHU Airflow Rate (cfm/ton)	Refrigerant Charge	Return Duct Design - Table 150.0-B or C

<<reference value from B01>>	<<auto filled from B02>>	<< calculated field:
		If B04=no, then value=N/A;
		
		else Default Value=No Exemptions;
		allow user to override the default and pick one from list:
		' Ducts have previously been sealed, tested, and certified by a HERS rater;
		' Duct system has less than 40 ft of duct in unconditioned spaces;
		' Duct system is insulated or sealed with asbestos;
		
		flag non-default values and report in project status notes field; The enforcement agency may require additional documentation as validation>>
			<<Calculated field:
			if value in B04=no (system with no ducts),
			then display result in this field=no
			
			elseif J03=N/A,
			then display result in this field=no,
			
			elseif J03 ≠ No Exemptions,
			then display result = no;
			
			elseif J03= No Exemptions,
			then determine the result for this field by the user responses in B04, B05 , B06, B07, B08, B09 and use of Logic Table for Determining Alteration Type and HERS Verification Requirements (inserted below section B);
			constrain user input for fields B04-B09 to allow only the available combinations of responses given in the Logic Table in rows a through q;
			If the term "DctLk" appears in the HERS column, then display result=yes in this field (duct leakage test required);
			elseif the term "DctLk" does not appear in the HERS column, then display result=no in this field >>
				<<calculated field:
				If B04=no, then value=N/A;
				
				elseif C11=N/A,
				then value=N/A;
				
				else
				Default Value=No Exemption;
				allow user to override the default and select result=yes>>
					<< Calculated field:
					if the value in J05= yes,
					and if the values in either G04 or G05 or F02 are <C12
					then display result in this field=yes;
					
					else display result=no>>
						<< Calculated field:
						if value in B04=no (system with no ducts),
						then display result in this field=no
						
						elseif the value in G07= HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton),
						then display result in this field=yes;
						
						elseif all of the following three conditions are true:
						' 'B09=yes
						' 'C05=no cooling
						' 'C13=CFISystem,
						then result= yes;
						
						else display result=no>>
							<< Calculated field:
							if value in B04=no (system with no ducts),
							then display result in this field=no
							
							elseif the value in G07= HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton),
							then display result in this field= 'yes ';
							
							elseif the value in J09=yes, then
							if value in J10=no,
							then display result in this field=yes
							
							elseif all of the following three conditions are true:
							' 'B09=yes
							' 'C05=no cooling
							' 'C13=CFISystem,
							then result= yes;
							
							else display result= 'no '>>
								<< Calculated field:
								determine by the user responses in B04, B05 , B06, B07, B08, B09 and use of 'Logic Table for Determining Alteration Type and HERS Verification Requirements ' (inserted below section B);
								constrain user input for fields B04-B09 to allow only the available combinations of responses given in the Logic Table in rows a through q;
								
								If the term "RC" appears in the HERS column, and if A02 =C2 2,8,9, 10,11,12,13,14, or 15,
								then display result = yes in this field (Refrigerant Charge Verification required);
								
								else display result = no>>
									<< Calculated field:
									if value in B04=no (system with no ducts),
									then display result in this field=no
									
									elseif the value in G07= HERS verified Return Duct Design per Table 150.0-B,C;
									then display result in this field= 'yes ';
									
									elsedisplay result= 'no '>>

Notes:

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CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 13 of 14)

K. Space Conditioning Systems, Ducts and Fans – Mandatory Requirements and Additional Measures Note: Additional mandatory requirements from Section 150.0 that are not listed here may be applicable to some systems. These requirements may be applicable to only newly installed equipment or portions of the system that are altered. Existing equipment may be exempt from these requirements.	
Heating Equipment	
01	Equipment Efficiency: All heating equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.
02	Controls: All unitary heating systems, including heat pumps, must be controlled by a setback thermostat. These thermostats must be capable of allowing the occupant to program the temperature set points for at least four different periods in 24 hours. See Sections 150.0(i), 110.2(b).
03	Sizing: Heating load calculations must be done on portions of the building served by new heating systems to prevent inadvertent undersizing or oversizing. See sections 150.0(h)1 and 2).
04	Furnace Temperature Rise: Central forced-air heating furnace installations must be configured to operate at or below the furnace manufacturer's maximum inlet-to-outlet temperature rise specification. See Section 150.0(h)4.
05	Standby Losses and Pilot Lights: Fan-type central furnaces may not have a continuously burning pilot light. Section 110.5 and Section 110.2(d).
Cooling Equipment	
06	Equipment Efficiency: All cooling equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.
07	Refrigerant Line Insulation: All refrigerant line insulation in split system air conditioners and heat pumps must meet the R-value and protection requirements of Section 150.0(j)2 and 3, and Section 150.0(m)9.
08	Condensing Unit Location: Condensing units shall not be placed within 5 feet of a dryer vent outlet. See Section 150.0(h)3A.
09	Liquid Line Filter Drier: If applicable, a liquid line filter drier shall be installed according to the manufacturer's specifications.
10	Sizing: Cooling load calculations must be done on portions of the building served by new cooling systems to prevent inadvertent undersizing or oversizing. See Section 150.0(h)1 and 2.
Air Distribution System Ducts, Plenums and Fans	
11	Insulation: In all cases, unless ducts are enclosed entirely in directly conditioned space, the minimum duct insulation value is R-6. Note that higher values may be required by the prescriptive or performance requirements. See Section 150.0(m)1.
12	Connections and Closures: All installed air-distribution system ducts and plenums must be, sealed and insulated to meet the requirements of CMC Sections 601.0, 602.0, 603.0, 604.0, 605.0 and ANSI/SMACNA-006-2006: Supply-air and return-air ducts and plenums must be insulated to a minimum installed level of R-6.0 or enclosed entirely in directly conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.
Heat Pump Thermostat	
13	A thermostat shall be installed that meets the requirements of Section 110.2(b) and Section 110.2(c).
14	The thermostat shall be installed in accordance with the manufacturers published installation specifications.
15	First stage of heating shall be assigned to heat pump heating.
16	Second stage back up heating shall be set to come on only when the indoor set temperature cannot be met.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

For information and data collection only. Not valid until registered with a HERS provider.

CERTIFICATE OF INSTALLATION - DATA FIELD DEFINITIONS AND CALCULATIONS	CF2R-MCH-01-E
Space Conditioning Systems Ducts and Fans	(Page 14 of 14)

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Installation documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Documentation Author Company Name:	Date Signed:
Address:	CEA/HERS Certification Identification (If applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Installation is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction, or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Installation, and attest to the declarations in this statement (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer.
3. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.
4. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met.
5. I will ensure that a registered copy of this Certificate of Installation shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a registered copy of this Certificate of Installation is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Builder/Installer Name:	Responsible Builder/Installer Signature:	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner)	Position With Company (Title):	
Address:	CSLB License:	
City/State/Zip:	Phone:	Date Signed:

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Appendix B
Compliance Document XML Schema Files (XSD)

Note: At the end of Appendix B the contents of CF2RMCH01bE.xsd (prescriptive alterations to space conditioning systems) is displayed for information purposes only. For information for implementation of the MCH-01b schema, refer to the current version of the file maintained in the applicable Energy Commission XSD repository at the following URL.

https://cecbees.unfuddle.com/svn/cecbees_cecrgtestingtwentysixteen/

CF1RADD01E.xsd
CF1RALT02E.xsd
CF1RENV02E.xsd
CF1RENV03E.xsd
CF1RNCB01E.xsd
CF1RPLB01E.xsd
CF1RSRA01E.xsd
CF1RSRA02E.xsd
CF1RSTH01E.xsd
CF1RSTH02E.xsd
CF2RENV01E.xsd
CF2RENV03E.xsd
CF2RENV04E.xsd
CF2RENV20aH.xsd
CF2RENV20bH.xsd
CF2RENV20cH.xsd
CF2RENV20dH.xsd
CF2RENV20eH.xsd
CF2RLTG01E.xsd
CF2RLTG02E.xsd
CF2RMCH01aE.xsd
CF2RMCH01bE.xsd
CF2RMCH01cE.xsd
CF2RMCH02E.xsd
CF2RMCH04E.xsd
CF2RMCH20aH.xsd
CF2RMCH20bH.xsd
CF2RMCH20cH.xsd
CF2RMCH20dH.xsd
CF2RMCH20eH.xsd
CF2RMCH21H.xsd
CF2RMCH22aH.xsd
CF2RMCH22bH.xsd
CF2RMCH23aH.xsd

CF2RMCH23bH.xsd
CF2RMCH23cH.xsd
CF2RMCH23dH.xsd
CF2RMCH24aH.xsd
CF2RMCH24bH.xsd
CF2RMCH24cH.xsd
CF2RMCH24dH.xsd
CF2RMCH24eH.xsd
CF2RMCH25aH.xsd
CF2RMCH25bH.xsd
CF2RMCH25cH.xsd
CF2RMCH25eH.xsd
CF2RMCH25fE.xsd
CF2RMCH26H.xsd
CF2RMCH27aH.xsd
CF2RMCH27bH.xsd
CF2RMCH27cH.xsd
CF2RMCH27dH.xsd
CF2RMCH28H.xsd
CF2RMCH29H.xsd
CF2RPLB01E.xsd
CF2RPLB02E.xsd
CF2RPLB03E.xsd
CF2RPLB21H.xsd
CF2RPLB22H.xsd
CF2RSPV01aE.xsd
CF2RSPV01bE.xsd
CF2RSPV01cE.xsd
CF3RENV20aH.xsd
CF3RENV20bH.xsd
CF3RENV20cH.xsd
CF3RENV20dH.xsd
CF3RENV20eH.xsd
CF3RENV21H.xsd
CF3RENV22H.xsd
CF3RENV23H.xsd
CF3RENV24H.xsd
CF3RFeatureNotTestedH.xsd
CF3RMCH20aH.xsd
CF3RMCH20bH.xsd
CF3RMCH20cH.xsd
CF3RMCH20dH.xsd
CF3RMCH20eH.xsd
CF3RMCH21H.xsd
CF3RMCH22aH.xsd

CF3RMCH22bH.xsd
CF3RMCH23aH.xsd
CF3RMCH23bH.xsd
CF3RMCH23cH.xsd
CF3RMCH23dH.xsd
CF3RMCH24aH.xsd
CF3RMCH24bH.xsd
CF3RMCH24cH.xsd
CF3RMCH24dH.xsd
CF3RMCH24eH.xsd
CF3RMCH25aH.xsd
CF3RMCH25bH.xsd
CF3RMCH25cH.xsd
CF3RMCH25dH.xsd
CF3RMCH25eH.xsd
CF3RMCH26H.xsd
CF3RMCH27aH.xsd
CF3RMCH27bH.xsd
CF3RMCH27cH.xsd
CF3RMCH27dH.xsd
CF3RMCH28H.xsd
CF3RMCH29H.xsd
CF3RPLB21H.xsd
CF3RPLB22H.xsd
NRCVMCH04aH.xsd
NRCVMCH04cH.xsd
NRCVMCH04dH.xsd
NRCVMCH04eH.xsd
NRCVPLB21H.xsd
NRCVPLB22H.xsd
DataTypes.xsd
ResBuilding.xsd
ResCommon.xsd
ResCompliance.xsd
ResEnvelope.xsd
ResHvac.xsd
ResLighting.xsd

The contents of the file named CF2RMch01bE.xsd follows.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns="http://www.lmonte.com/besm/CF2RMCH01bE" xmlns:bld="http://www.lmonte.com/besm/bld" xmlns:env="http://www.lmonte.com/besm/env" xmlns:lit="http://www.lmonte.com/besm/lit" xmlns:hvac="http://www.lmonte.com/besm/hvac" xmlns:comp="http://www.lmonte.com/besm/comp" xmlns:com="http://www.lmonte.com/besm/com" xmlns:dtyp="http://www.lmonte.com/besm/dtyp" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:altova="http://www.altova.com/xml-schema-extensions" targetNamespace="http://www.lmonte.com/besm/CF2RMCH01bE" elementFormDefault="qualified" attributeFormDefault="unqualified" version="2016.1.001">
  <xsd:import namespace="http://www.lmonte.com/besm/com" schemaLocation="../base/ResCommon.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/bld" schemaLocation="../base/ResBuilding.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/env" schemaLocation="../base/ResEnvelope.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/lit" schemaLocation="../base/ResLighting.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/hvac" schemaLocation="../base/ResHvac.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/comp" schemaLocation="../base/ResCompliance.xsd"/>
  <xsd:import namespace="http://www.lmonte.com/besm/dtyp" schemaLocation="../base/DataTypes.xsd"/>
  <xsd:element name="ComplianceDocumentPackage">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="DocID" minOccurs="0">
          <xsd:complexType>
            <xsd:attribute name="doc" type="comp:ComplianceDocumentTag" fixed="CF2RMCH01bE"/>
            <xsd:attribute name="docType" type="comp:ComplianceDocumentType" fixed="CERTIFICATE OF INSTALLATION"/>
            <xsd:attribute name="docTitle" type="comp:ComplianceDocumentTitleRes" fixed="Space Conditioning Systems, Ducts, and Fans"/>
            <xsd:attribute name="docVariantSubtitle" type="comp:ComplianceDocumentVariantSubtitle" fixed="MCH01b Prescriptive Alterations"/>
            <xsd:attribute name="docVariantLetter" type="comp:ComplianceDocumentVariant" fixed="b"/>
          </xsd:complexType>
        </xsd:element>
        <xsd:element name="Payload" type="comp:Payload"/>
        <xsd:element name="DocumentData">
          <xsd:complexType>
            <xsd:sequence>
              <xsd:element name="Header" type="comp:HeaderCF2R_3R"/>
              <xsd:element ref="cF2RMCH01bE"/>
              <xsd:element name="DocAuthor" type="comp:DocumentAuthor"/>
              <xsd:element name="RespPerson" type="comp:ResponsiblePersonCF2R_E"/>
              <xsd:element name="Footer" type="comp:Footer"/>
            </xsd:sequence>
          </xsd:complexType>
        </xsd:element>
        <xsd:element name="Report" type="xsd:base64Binary"/>
      </xsd:sequence>
      <xsd:attribute name="revision" type="xsd:string" use="required" fixed="rev 09/15"/>
      <xsd:attribute name="doc" type="comp:ComplianceDocumentTag" use="required" fixed="CF2RMCH01bE"/>
    </xsd:complexType>
  </xsd:element>
  <xsd:complexType name="CF2RMCH01bE">
    <xsd:annotation>
      <xsd:documentation>Space Conditioning Systems, Ducts, and Fans - MCH01b Prescriptive Alterations</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="Section_A" minOccurs="1" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation source="FieldText">General Information</xsd:documentation>
          <xsd:documentation source="MinOccurs">This section is required.</xsd:documentation>
        </xsd:annotation>
        <xsd:complexType>
          <xsd:sequence>
            <xsd:element name="A01_ResidentialDwellingUnitName" type="com:ResidentialDwellingUnitName">
              <xsd:annotation>
                <xsd:documentation source="FieldText">Dwelling Unit Name</xsd:documentation>
                <xsd:documentation source="CalculationsAndRules">Reference text from CF1R</xsd:documentation>
              </xsd:annotation>
            </xsd:element>
            <xsd:element name="A02_ClimateZone" type="com:ClimateZone">
              <xsd:annotation>
```

```
                        <xsd:documentation source="FieldText">Climate Zone</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">Reference text from CF1R</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="A03_DwellingUnitConditionedFloorArea" type="com:DwellingUnitConditionedFloorArea">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Dwelling Unit Total Conditioned Floor Area (ft2)</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">Value is numeric: xxxxx  If CF1R parent is CF1R-PRF, then if project scope is Newly Constructed (Addition Alone) then prompt user to enter a value equal to dwelling unit existing CFA + addition CFA, else reference the value from CF1R;  Else If CF1R parent is CF1R-NCB-01, then If ProjectScopeNew = AdditionGT1000 then prompt user to enter a value equal to dwelling unit existing CFA + addition CFA, else if ProjectScopeNew = NewBuildingConstruction, then if ResidentialLowriseBuildingType = SingleFamily, then reference value from CF1R-NCB field A10, Else if ResidentialLowriseBuildingType = LowRiseMultiFamily, then reference value from CF1R-NCB field M02;  Else If CF1R parent is CF1R-ADD-01, then if ResidentialLowriseBuildingType = SingleFamily, then reference value from CF1R-ADD field J02, else if ResidentialLowriseBuildingType = LowRiseMultiFamily, then reference value from CF1R-ADD field L02;  Else If CF1R parent is CF1R-ALT-01, then if ResidentialLowriseBuildingType = SingleFamily, then reference value from CF1R-ALT field G02, else if ResidentialLowriseBuildingType = LowRiseMultiFamily, then reference value from CF1R-ALT field I02.  Allow user to override default and input value; flag overridden values and report in project status notes field.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="A04_ResidentialDwellingUnitSpaceConditioningCount" type="hvac:ResidentialDwellingUnitSpaceConditioningCount">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Number of space conditioning (SC) systems being altered in this dwelling unit.</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02 doc type, then use as default the value referenced from CF1R ALT-02 Section A; or allow user to override the default and input a new value;  flag non-default values and report in project status notes field;  Else if  parent is not CF1R-ALT-02 doc type, then user input the integer value</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="A05_ComplianceMethod" type="comp:ComplianceMethod">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Certificate of Compliance Type</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">Reference document type property from CF1R; For choice Performance display text: performance (CF1R-PRF); for choice PrescriptiveAdditions display text:  prescriptive additions (CF1R-ADD)  For choice PrescriptiveAlterations display text: prescriptive alterations (CF1R-ALT);  For choice PrescriptiveNewConstruction display text: prescriptive newly constructed (CF1R-NCB)</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="A06_HvacLoadCalculationMethod" type="comp:HvacLoadCalculationMethod">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Method used to calculate HVAC loads</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">User input;  Choices to display: ASHRAE Handbook; SMACNA Residential Comfort System Installation Standards Manual, ACCA Manual J, Not applicable - equipment change out, like-for-like.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:choice maxOccurs="1">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Calculated dwelling unit Sensible Cooling Load (Btuh)</xsd:documentation>
                        <xsd:documentation source="CalculationsAndRules">If  HvacLoadCalculationMethod equals Not applicable - equipment change out, like-for-like  Then result is N/A stored in the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
                    </xsd:annotation>
                    <xsd:element name="A07_DesignSensibleCoolingLoad" type="hvac:DesignSensibleCoolingLoad"/>
                    <xsd:element name="A07_NotApplicableMessage" type="comp:NotApplicableMessage">
                        <xsd:annotation>
                            <xsd:documentation source="FieldText">Calculated dwelling unit Sensible Cooling Load (Btuh)</xsd:documentation>
                            <xsd:documentation source="CalculationsAndRules">If  HvacLoadCalculationMethod equals Not applicable - equipment change out, like-for-like  Then result is N/A stored in the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
                        </xsd:annotation>
                    </xsd:element>
                </xsd:choice>
```

```
101                  <xsd:choice maxOccurs="1">
102                     <xsd:annotation>
103                        <xsd:documentation source="FieldText">Calculated Dwelling Unit Heating Load (Btuh)</xsd:documentation>
104                        <xsd:documentation source="CalculationsAndRules">If  HvacLoadCalculationMethod equals Not applicable
    - equipment change out, like-for-like  Then result is N/A stored in the  NotAppplicableMessage Else User entry integer xxxxx</
    xsd:documentation>
105                     </xsd:annotation>
106                     <xsd:element name="A08_DwellingUnitDesignHeatingLoad" type="hvac:DwellingUnitDesignHeatingLoad"/>
107                     <xsd:element name="A08_NotApplicableMessage" type="comp:NotApplicableMessage">
108                        <xsd:annotation>
109                           <xsd:documentation source="FieldText">Calculated Dwelling Unit Heating Load (Btuh)</
    xsd:documentation>
110                           <xsd:documentation source="CalculationsAndRules">If  HvacLoadCalculationMethod equals Not
    applicable - equipment change out, like-for-like  Then result is N/A stored in the  NotAppplicableMessage Else User entry
    integer xxxxx</xsd:documentation>
111                        </xsd:annotation>
112                     </xsd:element>
113                  </xsd:choice>
114                  <xsd:element name="A09_BedroomCount" type="com:BedroomCount">
115                     <xsd:annotation>
116                        <xsd:documentation source="FieldText">Dwelling Unit Number of Bedrooms</xsd:documentation>
117                        <xsd:documentation source="CalculationsAndRules">Calculated field: integer xx;  If ComplianceMethod =
    Performance Then use as default the value referenced from the CF1F-PRF Or allow user to override  default and input a new
    value which requires a flag the non-default value and report of change in the project status notes field.  Else (parent not
    CF1R-PRF) user inputs integer value.</xsd:documentation>
118                     </xsd:annotation>
119                  </xsd:element>
120                  <xsd:element name="A09After" minOccurs="0">
121                     <xsd:annotation>
122                        <xsd:documentation source="FieldText">Variant MCH-01b</xsd:documentation>
123                        <xsd:documentation source="AdditionalRequirements">MCH-01b Prescriptive Alterations - Space
    Conditioning Systems Ducts and Fans</xsd:documentation>
124                        <xsd:documentation source="CalculationsAndRules">If CF1R type is CF1R-PRF AND project scope is one
    of the following two values: Newly Constructed (addition alone) Or Addition and/or Alteration  AND addition conditioned floor
    area is greater than 1 sqft AND there are NO HVAC System compliance requirements given on the CF1R-PRF for the building
    Then use MCH-01b for the remainder of this compliance document, Else If ComplianceMethod equals Performance, use
    MCH01a for the remainder of this compliance document; ElseIf ComplianceMethod equals PrescriptiveAlterations, or
    PrescriptiveAddiitions, use MCH01b for the remainder of this compliance document;  ElseIf ComplianceMethod  equals
    PrescriptiveNewConstruction use MCH01c for the remainder of this compliance document.</xsd:documentation>
125                     </xsd:annotation>
126                  </xsd:element>
127               </xsd:sequence>
128            </xsd:complexType>
129         </xsd:element>
130         <xsd:element name="Section_B" minOccurs="1">
131            <xsd:annotation>
132               <xsd:documentation source="FieldText">Space Conditioning (SC) System Information</xsd:documentation>
133               <xsd:documentation source="CalculationsAndRules">For this table every field except the last should reference
    values from CF1R as default; allow user to override the default and input a new value;  flag non-default values and report in
    project status notes field; a revised CF1R may be required</xsd:documentation>
134               <xsd:documentation source="MinOccurs">This section is required.</xsd:documentation>
135            </xsd:annotation>
136            <xsd:complexType>
137               <xsd:sequence>
138                  <xsd:element name="Table">
139                     <xsd:complexType>
140                        <xsd:sequence>
141                           <xsd:element name="Row" maxOccurs="unbounded">
142                              <xsd:complexType>
143                                 <xsd:sequence>
144                                    <xsd:element name="B01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
145                                       <xsd:annotation>
146                                          <xsd:documentation source="FieldText">SC System Identification or Name</
    xsd:documentation>
147                                          <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used</xsd:documentation>
```

```
148                                 </xsd:annotation>
149                               </xsd:element>
150                               <xsd:element name="B02_ResidentialHvacSystemAreaServed" type="
    hvac:ResidentialHvacSystemAreaServed">
151                                 <xsd:annotation>
152                                   <xsd:documentation source="FieldText">SC System Location or Area Served</
    xsd:documentation>
153                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used</xsd:documentation>
154                                 </xsd:annotation>
155                               </xsd:element>
156                               <xsd:element name="B03_ResidentialHvacSystemConditionedArea" type="
    hvac:ResidentialHvacSystemConditionedArea">
157                                 <xsd:annotation>
158                                   <xsd:documentation source="FieldText">CFA served by this SC System (ft2)</
    xsd:documentation>
159                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used</xsd:documentation>
160                                 </xsd:annotation>
161                               </xsd:element>
162                               <xsd:element name="B04_DuctedSystem" type="comp:DuctedSystem">
163                                 <xsd:annotation>
164                                   <xsd:documentation source="FieldText">Is the SC system a ducted system?</
    xsd:documentation>
165                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used.  Display Yes and No to represent Boolean values true and false</xsd:documentation>
166                                 </xsd:annotation>
167                               </xsd:element>
168                               <xsd:element name="B05_IncludesComponentWithRefrigerant" type="
    comp:IncludesComponentWithRefrigerant">
169                                 <xsd:annotation>
170                                   <xsd:documentation source="FieldText">Installing a refrigerant containing component?</
    xsd:documentation>
171                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used  Display Yes and No to represent Boolean values true and false</xsd:documentation>
172                                 </xsd:annotation>
173                               </xsd:element>
174                               <xsd:element name="B06_InstallingNewComponents" type="comp:InstallingNewComponents">
175                                 <xsd:annotation>
176                                   <xsd:documentation source="FieldText">Installing new SC system components?</
    xsd:documentation>
177                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used.  Display Yes and No to represent Boolean values true and false</xsd:documentation>
178                                 </xsd:annotation>
179                               </xsd:element>
180                               <xsd:element name="B07_Installing40PlusLinearFeetDucts" type="
    comp:Installing40PlusLinearFeetDucts">
181                                 <xsd:annotation>
182                                   <xsd:documentation source="FieldText">Installing more than 40 feet of  ducts?</
    xsd:documentation>
183                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used.  Display Yes and No to represent Boolean values true and false</xsd:documentation>
184                                 </xsd:annotation>
185                               </xsd:element>
186                               <xsd:element name="B08_DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced"
    type="comp:DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced">
187                                 <xsd:annotation>
188                                   <xsd:documentation source="FieldText">Installing entirely new duct system?</
    xsd:documentation>
189                                   <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system
    names to be used.  Display Yes and No to represent Boolean values true and false</xsd:documentation>
```

```
                                    </xsd:annotation>
                                </xsd:element>
                                <xsd:element name="B09_AllNewOrReplacedHvacSystem" type="comp:AllNewOrReplacedHvacSystem">
                                    <xsd:annotation>
                                        <xsd:documentation source="FieldText">Installing entirely new SC system?</xsd:documentation>
                                        <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  do not duplicate system names to be used.  Display Yes and No to represent Boolean values true and false</xsd:documentation>
                                    </xsd:annotation>
                                </xsd:element>
                                <xsd:element name="B10_ResidentialHvacAlterationType" type="hvac:ResidentialHvacAlterationType">
                                    <xsd:annotation>
                                        <xsd:documentation source="FieldText">Alteration Type</xsd:documentation>
                                        <xsd:documentation source="CalculationsAndRules">Provide controls for user input to either 1) determine the correct result for alteration type for entry in this field by prompting the user to respond with any data input needed for use of the logic in Logic Table for Determining Alteration Type and HERS Verification Requirements which is provided in the Residential Compliance Documents workbook.  Constrain user input for fields B04-B09 to allow only the available combinations of responses given in the Logic Table in rows a through s;  or 2) allow the user to pick an alteration type from ResidentialHvacAlterationType values.  For choice DuctSystemExistingExtended display text: Extension of Existing Duct System;  For choice SpaceConditioningSystemAltered display text: Altered Space Conditioning System;  For choice DuctSystemEntirelyNewReplacement display text: Entirely New or Complete Replacement Duct System with or without Equipment Changeout; For choice SpaceConditioningSystemEntirelyNewReplacement display text: Entirely New or Complete Replacement Space Conditioning System; For choice NoAlterationsPerformed display text: No Alteration Performed</xsd:documentation>
                                    </xsd:annotation>
                                </xsd:element>
                            </xsd:sequence>
                        </xsd:complexType>
                    </xsd:element>
                </xsd:sequence>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name="Section_C" minOccurs="1">
            <xsd:annotation>
                <xsd:documentation source="FieldText">Space Conditioning (SC) System Alterations Compliance Information</xsd:documentation>
                <xsd:documentation source="CalculationsAndRules">Require one row of data in this table for each of the SC Systems listed in Section B for which ResidentialHvacAlterationType in B10 does not equal  NoAlterationsPerformed</xsd:documentation>
                <xsd:documentation source="MinOccurs">This section is required.</xsd:documentation>
            </xsd:annotation>
            <xsd:complexType>
                <xsd:sequence>
                    <xsd:element name="Table2">
                        <xsd:complexType>
                            <xsd:sequence>
                                <xsd:element name="Row" maxOccurs="unbounded">
                                    <xsd:complexType>
                                        <xsd:sequence>
                                            <xsd:element name="C01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
                                                <xsd:annotation>
                                                    <xsd:documentation source="FieldText">System Identification or Name</xsd:documentation>
                                                    <xsd:documentation source="CalculationsAndRules">Reference to one of the ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                            <xsd:choice maxOccurs="1">
                                                <xsd:annotation>
                                                    <xsd:documentation source="FieldText">Heating System Type</xsd:documentation>
                                                    <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
```

```
jrm\Wor names to be used.; allow user to override the default. Allow for N/A stored in the NotApplicableMessage if there is no heating;
Flag non-default values and report in project status notes field; a revised CF1R may be required</xsd:documentation>
237                                 </xsd:annotation>
238                                 <xsd:element name="C02_NotApplicableMessage" type="comp:NotApplicableMessage"/>
239                                 <xsd:element name="C02_ResidentialHeatingSystemType" type="
    hvac:ResidentialHeatingSystemType"/>
240                              </xsd:choice>
241                              <xsd:sequence maxOccurs="unbounded">
242                                 <xsd:annotation>
243                                    <xsd:documentation source="FieldText">Altered Heating Component</xsd:documentation>
244                                    <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
    names to be used. allow user to override the default.  Flag non-default values and report in project status notes field; a revised
    CF1R may be required</xsd:documentation>
245                                 </xsd:annotation>
246                                 <xsd:element name="C03_ResidentialHvacHeatiingComponentType" type="
    hvac:ResidentialHvacHeatiingComponentType"/>
247                              </xsd:sequence>
248                              <xsd:choice maxOccurs="1">
249                                 <xsd:annotation>
250                                    <xsd:documentation source="FieldText">Heating Efficiency Type</xsd:documentation>
251                                    <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
    names to be used. if C03 equals NoHeatingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
    allow user to override the default.  Flag non-default values and report in project status notes field; a revised CF1R may be
    required</xsd:documentation>
252                                 </xsd:annotation>
253                                 <xsd:element name="C04_EfficiencyType">
254                                    <xsd:simpleType>
255                                       <xsd:restriction base="hvac:EfficiencyType">
256                                          <xsd:enumeration value="AFUE"/>
257                                          <xsd:enumeration value="COP"/>
258                                          <xsd:enumeration value="HSPF"/>
259                                       </xsd:restriction>
260                                    </xsd:simpleType>
261                                 </xsd:element>
262                                 <xsd:element name="C04_NotApplicableMessage" type="comp:NotApplicableMessage">
263                                    <xsd:annotation>
264                                       <xsd:documentation source="FieldText">Heating Efficiency Type</xsd:documentation>
265                                       <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
    names to be used.; if C03 equals NoHeatingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
    allow user to override the default.  Flag non-default values and report in project status notes field; a revised CF1R may be
    required</xsd:documentation>
266                                    </xsd:annotation>
267                                 </xsd:element>
268                              </xsd:choice>
269                              <xsd:choice maxOccurs="1">
270                                 <xsd:annotation>
271                                    <xsd:documentation source="FieldText">Heating Minimum Efficiency Value</
    xsd:documentation>
272                                    <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
    names to be used.  if C03 equals NoHeatingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
    allow user to override the default.  If user changes value from CF1R value, this rule applies: If EfficiencyType = AFUE, Then
    Report default minimum value is  0.78; Else If EfficiencyType = HSPF Then Report default minimum value  is 7.7; Flag
    non-default values and report in project status notes field;</xsd:documentation>
273                                 </xsd:annotation>
274                                 <xsd:element name="C05_EfficiencyMinimumValueAFUE" type="
    hvac:EfficiencyMinimumValueAFUE"/>
275                                 <xsd:element name="C05_EfficiencyMinimumValueCOP" type="
    hvac:EfficiencyMinimumValueCOP"/>
276                                 <xsd:element name="C05_EfficiencyMinimumValueHSPF" type="
    hvac:EfficiencyMinimumValueHSPF"/>
277                                 <xsd:element name="C05_NotApplicableMessage" type="comp:NotApplicableMessage">
278                                    <xsd:annotation>
279                                       <xsd:documentation source="FieldText">Heating Minimum Efficiency Value</
```

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280                                 <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used. if C03 equals NoHeatingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
allow user to override the default.  If user changes value from CF1R value, this rule applies: If EfficiencyType = AFUE, Then
Report default minimum value is  0.78; Else If EfficiencyType = HSPF Then Report default minimum value  is 7.7; Flag
non-default values and report in project status notes field;</xsd:documentation>
281                                 </xsd:annotation>
282                              </xsd:element>
283                           </xsd:choice>
284                           <xsd:element name="C06_ResidentialCoolingSystemType" type="
hvac:ResidentialCoolingSystemType">
285                              <xsd:annotation>
286                                 <xsd:documentation source="FieldText">Cooling System Type</xsd:documentation>
287                                 <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used.  Allow user to override the default.  Flag non-default values and report in project status notes field; a revised
CF1R may be required</xsd:documentation>
288                              </xsd:annotation>
289                           </xsd:element>
290                           <xsd:sequence maxOccurs="unbounded">
291                              <xsd:annotation>
292                                 <xsd:documentation source="FieldText">Altered Cooling Component</xsd:documentation>
293                                 <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used. Allow user to override the default.  Flag non-default values and report in project status notes field; a revised
CF1R may be required</xsd:documentation>
294                              </xsd:annotation>
295                              <xsd:element name="C07_ResidentialHvacCoolingComponentType" type="
hvac:ResidentialHvacCoolingComponentType"/>
296                           </xsd:sequence>
297                           <xsd:choice maxOccurs="1">
298                              <xsd:annotation>
299                                 <xsd:documentation source="FieldText">Cooling Efficiency Type</xsd:documentation>
300                                 <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used. If C04 equals NoCoolingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
allow user to override the default.  Flag non-default values and report in project status notes field; a revised CF1R may be
required</xsd:documentation>
301                              </xsd:annotation>
302                              <xsd:element name="C08_EfficiencyType">
303                                 <xsd:simpleType>
304                                    <xsd:restriction base="hvac:EfficiencyType">
305                                       <xsd:enumeration value="EER"/>
306                                       <xsd:enumeration value="SEER"/>
307                                    </xsd:restriction>
308                                 </xsd:simpleType>
309                              </xsd:element>
310                              <xsd:element name="C08_NotApplicableMessage" type="comp:NotApplicableMessage">
311                                 <xsd:annotation>
312                                    <xsd:documentation source="FieldText">Cooling Efficiency Type</xsd:documentation>
313                                    <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used.  If C04 equals NoCoolingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
allow user to override the default.  Flag non-default values and report in project status notes field; a revised CF1R may be
required.</xsd:documentation>
314                                 </xsd:annotation>
315                              </xsd:element>
316                           </xsd:choice>
317                           <xsd:choice maxOccurs="1">
318                              <xsd:annotation>
319                                 <xsd:documentation source="FieldText">Cooling Minimum Efficiency Value</
xsd:documentation>
320                                 <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
names to be used.  If C04 equals NoCoolingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
allow user to override the default.  If user changes value from CF1R value, this rule applies: If EfficiencyType = SEER, Then
Report default minimum value of 13; Flag non-default values and report in project status notes field;  a revised CF1R may be
required.</xsd:documentation>
```

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321                                 </xsd:annotation>
322                                 <xsd:element name="C09_EfficiencyMinimumValueSEER" type="
    hvac:EfficiencyMinimumValueSEER"/>
323                                 <xsd:element name="C09_EfficiencyMinimumValueEER" type="
    hvac:EfficiencyMinimumValueEER"/>
324                                 <xsd:element name="C09_NotApplicableMessage" type="comp:NotApplicableMessage">
325                                    <xsd:annotation>
326                                       <xsd:documentation source="FieldText">Cooling Minimum Efficiency Value</
    xsd:documentation>
327                                       <xsd:documentation source="CalculationsAndRules">If parent is CF1R-ALT-02, then
    reference values from CF1R as default, Else If parent is CF1R-PRF, then prompt user to enter value;  Do not duplicate system
    names to be used. If C04 equals NoCoolingComponentsAltered, then result is N/A stored in the NotApplicableMessage; else
    allow user to override the default.  If user changes value from CF1R value, this rule applies: If EfficiencyType = SEER, Then
    Report default minimum value of 13; Flag non-default values and report in project status notes field;  a revised CF1R may be
    required.</xsd:documentation>
328                                    </xsd:annotation>
329                                 </xsd:element>
330                              </xsd:choice>
331                              <xsd:choice maxOccurs="1">
332                                 <xsd:annotation>
333                                    <xsd:documentation source="FieldText">Required Thermostat Type</xsd:documentation>
334                                    <xsd:documentation source="CalculationsAndRules">If ResidentialHvacAlterationType in
    section B equals DuctSystemExistingExtended Then Result is N/A stored in the NotApplicableMessage. Else result is
    SetbackThermostat stored inThermostatType</xsd:documentation>
335                                 </xsd:annotation>
336                                 <xsd:element name="C10_ThermostatType">
337                                    <xsd:simpleType>
338                                       <xsd:restriction base="hvac:ThermostatType">
339                                          <xsd:enumeration value="SetbackThermostat"/>
340                                       </xsd:restriction>
341                                    </xsd:simpleType>
342                                 </xsd:element>
343                                 <xsd:element name="C10_NotApplicableMessage" type="comp:NotApplicableMessage">
344                                    <xsd:annotation>
345                                       <xsd:documentation source="FieldText">Required Thermostat Type</xsd:documentation>
346                                       <xsd:documentation source="CalculationsAndRules">If ResidentialHvacAlterationType in
    section B equals DuctSystemExistingExtended Then Result is N/A stored in the NotApplicableMessage. Else result is
    SetbackThermostat stored inThermostatType</xsd:documentation>
347                                    </xsd:annotation>
348                                 </xsd:element>
349                              </xsd:choice>
350                              <xsd:choice maxOccurs="1">
351                                 <xsd:annotation>
352                                    <xsd:documentation source="FieldText">New or Replaced Duct Length</xsd:documentation>
353                                    <xsd:documentation source="CalculationsAndRules">Calculated field:  if B04 DuctedSystem
    is false, then result is N/A stored in NotApplicableMessage with display text: N/A   Else If parent is CF1R-ALT-02 then reference
    value from CF1R as default; allow user to override the default; Else If parent is CF1R-PRF, then prompt user to enter value;
    User choices are: GT40Ft display text: Greater than 40 feet, LTE40Ft display text: Less than or equal to 40 feet  stored in
    DuctExtendedLengthRange or N/A  stored in the NotApplicableMessage, display text: N/A - no ducts replaced.   Flag
    non-default values and report in project status notes field; a revised CF1R may be required.</xsd:documentation>
354                                 </xsd:annotation>
355                                 <xsd:element name="C11_DuctExtendedLengthRange" type="
    comp:DuctExtendedLengthRange"/>
356                                 <xsd:element name="C11_NotApplicableMessage" type="comp:NotApplicableMessage">
357                                    <xsd:annotation>
358                                       <xsd:documentation source="FieldText">New or Replaced Duct Length</
    xsd:documentation>
359                                       <xsd:documentation source="CalculationsAndRules">Calculated field:  if B04
    DuctedSystem is false, then result is N/A stored in NotApplicableMessage with display text: N/A   Else If parent is CF1R-ALT-02
    then reference value from CF1R as default; allow user to override the default; Else If parent is CF1R-PRF, then prompt user to
    enter value;  User choices are: GreaterThan40Feet display text: Greater than 40 feet, LessThanOrEqualTo40Feet display text:
    Less than or equal to 40 feet  stored in DuctExtendedLengthRange or N/A  stored in the NotApplicableMessage, display text:
    N/A - no ducts replaced.   Flag non-default values and report in project status notes field; a revised CF1R may be required.</
    xsd:documentation>
360                                    </xsd:annotation>
361                                 </xsd:element>
362                              </xsd:choice>
363                              <xsd:choice maxOccurs="1">
```

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364                                 <xsd:annotation>
365                                     <xsd:documentation source="FieldText">New Duct R-Value</xsd:documentation>
366                                     <xsd:documentation source="CalculationsAndRules">If DuctedSystem in section B equals
    false. Or  DuctExtendedLengthRange equals N/A, then result is N/A stored in NotApplicableMessage;  Else result is stored in
    DuctRValueLimit for the following evaluation: If  ClimateZone in section A equals  1-10, 12, 13, then result is R6. Else result is
    R8.</xsd:documentation>
367                                 </xsd:annotation>
368                                 <xsd:element name="C12_DuctRValueLimit" type="hvac:DuctRValueLimit"/>
369                                 <xsd:element name="C12_NotApplicableMessage" type="comp:NotApplicableMessage">
370                                     <xsd:annotation>
371                                         <xsd:documentation source="FieldText">New Duct R-Value</xsd:documentation>
372                                         <xsd:documentation source="CalculationsAndRules">If DuctedSystem in section B equals
    false. Or  DuctExtendedLengthRange equals N/A, then result is N/A stored in NotApplicableMessage;  Else result is stored in
    DuctRValueLimit for the following evaluation: If  ClimateZone in section A equals  1-10, 12, 13, then result is R6. Else result is
    R8.</xsd:documentation>
373                                     </xsd:annotation>
374                                 </xsd:element>
375                             </xsd:choice>
376                             <xsd:element name="C13_IsVentilationSystemCFI" type="comp:IsVentilationSystemCFI">
377                                 <xsd:annotation>
378                                     <xsd:documentation source="FieldText">Central Fan Integrated (CFI) Ventilation System
    Status</xsd:documentation>
379                                     <xsd:documentation source="CalculationsAndRules">User selects from list: for true value,
    display text CFI system; for false value display text Not CFI system.</xsd:documentation>
380                                 </xsd:annotation>
381                             </xsd:element>
382                         </xsd:sequence>
383                     </xsd:complexType>
384                 </xsd:element>
385             </xsd:sequence>
386         </xsd:complexType>
387     </xsd:element>
388 </xsd:sequence>
389 </xsd:complexType>
390 </xsd:element>
391 <xsd:element name="Section_D" minOccurs="0" maxOccurs="1">
392     <xsd:annotation>
393         <xsd:documentation source="FieldText">Installed Heating Equipment Information</xsd:documentation>
394         <xsd:documentation source="CalculationsAndRules">This Section is applicable only at least one SC System has a
    value for C03 that does not equal NoHeatingComponentsAltered.  If applicable, require one row of data in this table for each of
    the SC Systems listed in Section C  for which C03 does not equal NoHeatingComponentsAltered.</xsd:documentation>
395         <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
    statement 'This section does not apply to this project.'</xsd:documentation>
396     </xsd:annotation>
397     <xsd:complexType>
398         <xsd:sequence>
399             <xsd:element name="Table3">
400                 <xsd:complexType>
401                     <xsd:sequence>
402                         <xsd:element name="Row" maxOccurs="unbounded">
403                             <xsd:complexType>
404                                 <xsd:sequence>
405                                     <xsd:element name="D01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
406                                         <xsd:annotation>
407                                             <xsd:documentation source="FieldText">System Identification or Name</xsd:documentation>
408                                             <xsd:documentation source="CalculationsAndRules">Reference to one of the
    ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
409                                         </xsd:annotation>
410                                     </xsd:element>
411                                     <xsd:element name="D02_EfficiencyType">
412                                         <xsd:annotation>
413                                             <xsd:documentation source="FieldText">Heating Efficiency Type</xsd:documentation>
414                                             <xsd:documentation source="CalculationsAndRules">Reference to the Heating EfficiencyType
415 listed in section B for this system</xsd:documentation>
416                                         </xsd:annotation>
417                                         <xsd:simpleType>
418                                             <xsd:restriction base="hvac:EfficiencyType">
```

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419                                     <xsd:enumeration value="AFUE"/>
420                                     <xsd:enumeration value="COP"/>
421                                     <xsd:enumeration value="HSPF"/>
422                                   </xsd:restriction>
423                                 </xsd:simpleType>
424                               </xsd:element>
425                               <xsd:choice maxOccurs="1">
426                                 <xsd:annotation>
427                                   <xsd:documentation source="FieldText">Heating Efficiency Value</xsd:documentation>
428                                   <xsd:documentation source="CalculationsAndRules">Rule  If EfficiencyInstalledValue is less
    than Heating EfficiencyMinimumValue in section C, flag it as a non-compliant value and do not allow this document to be
    registered.</xsd:documentation>
429                                 </xsd:annotation>
430                                 <xsd:element name="D03_EfficiencyInstalledValueAFUE" type="
    hvac:EfficiencyInstalledValueAFUE"/>
431                                 <xsd:element name="D03_EfficiencyInstalledValueCOP" type="
    hvac:EfficiencyInstalledValueCOP"/>
432                                 <xsd:element name="D03_EfficiencyInstalledValueHSPF" type="
    hvac:EfficiencyInstalledValueHSPF">
433                                   <xsd:annotation>
434                                     <xsd:documentation source="FieldText">Heating Efficiency Value</xsd:documentation>
435                                     <xsd:documentation source="CalculationsAndRules">Rule  If EfficiencyInstalledValue is
    less than Heating EfficiencyMinimumValue in section C, flag it as a non-compliant value and do not allow this document to be
    registered.</xsd:documentation>
436                                   </xsd:annotation>
437                                 </xsd:element>
438                               </xsd:choice>
439                               <xsd:element name="D04_HeatingUnitManufacturer" type="comp:HeatingUnitManufacturer">
440                                 <xsd:annotation>
441                                   <xsd:documentation source="FieldText">Heating Unit Manufacturer</xsd:documentation>
442                                 </xsd:annotation>
443                               </xsd:element>
444                               <xsd:element name="D05_HeatingUnitModelNumber" type="comp:HeatingUnitModelNumber">
445                                 <xsd:annotation>
446                                   <xsd:documentation source="FieldText">Heating Unit Model Number</xsd:documentation>
447                                 </xsd:annotation>
448                               </xsd:element>
449                               <xsd:element name="D06_HeatingUnitSerialNumber" type="comp:HeatingUnitSerialNumber">
450                                 <xsd:annotation>
451                                   <xsd:documentation source="FieldText">Heating Unit Serial Number</xsd:documentation>
452                                 </xsd:annotation>
453                               </xsd:element>
454                               <xsd:element name="D07_HeatingEquipmentRatedCapacity" type="
    hvac:HeatingEquipmentRatedCapacity">
455                                 <xsd:annotation>
456                                   <xsd:documentation source="FieldText">Rated Heating Capacity, Output (Btu/hr)</
    xsd:documentation>
457                                 </xsd:annotation>
458                               </xsd:element>
459                             </xsd:sequence>
460                           </xsd:complexType>
461                         </xsd:element>
462                       </xsd:sequence>
463                     </xsd:complexType>
464                   </xsd:element>
465                   <xsd:element name="DEndNote1_SectionComments" type="comp:SectionComments" minOccurs="0">
466                     <xsd:annotation>
467                       <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
468                       <xsd:documentation source="AdditionalRequirements">Notes:</xsd:documentation>
469                     </xsd:annotation>
470                   </xsd:element>
471                 </xsd:sequence>
472               </xsd:complexType>
473             </xsd:element>
474             <xsd:element name="Section_E" minOccurs="0">
475               <xsd:annotation>
476                 <xsd:documentation source="FieldText">Installed Cooling Equipment Information:</xsd:documentation>
477                 <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  one or more systems in
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jim\Wor section C has  ResidentialCoolingSystemType
478  not equal to NoCooling.  Require one row of data in this table for each of the SC Systems listed in Section C that has a
     ResidentialCoolingSystemType  not equal to NoCooling, and ResidentialHvacCoolingComponentType  not equal to
     NoCoolingComponentsAltered</xsd:documentation>
479              <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
     statement 'This section does not apply to this project.'</xsd:documentation>
480           </xsd:annotation>
481           <xsd:complexType>
482              <xsd:sequence>
483                 <xsd:element name="Table4">
484                    <xsd:complexType>
485                       <xsd:sequence>
486                          <xsd:element name="Row" maxOccurs="unbounded">
487                             <xsd:complexType>
488                                <xsd:sequence>
489                                   <xsd:element name="E01_ResidentialSpaceConditioningSystemName" type="
     hvac:ResidentialSpaceConditioningSystemName">
490                                      <xsd:annotation>
491                                         <xsd:documentation source="FieldText">System Identification or Name</xsd:documentation>
492                                         <xsd:documentation source="CalculationsAndRules">Reference to one of the
     ResidentialSpaceConditioningSystemName listed in section C</xsd:documentation>
493                                      </xsd:annotation>
494                                   </xsd:element>
495                                   <xsd:element name="E02_EfficiencyType">
496                                      <xsd:annotation>
497                                         <xsd:documentation source="FieldText">Cooling Efficiency Type</xsd:documentation>
498                                         <xsd:documentation source="CalculationsAndRules">Reference to Cooling EfficiencyType in
     section C</xsd:documentation>
499                                      </xsd:annotation>
500                                      <xsd:simpleType>
501                                         <xsd:restriction base="hvac:EfficiencyType">
502                                            <xsd:enumeration value="EER"/>
503                                            <xsd:enumeration value="SEER"/>
504                                         </xsd:restriction>
505                                      </xsd:simpleType>
506                                   </xsd:element>
507                                   <xsd:choice maxOccurs="1">
508                                      <xsd:annotation>
509                                         <xsd:documentation source="FieldText">Cooling Efficiency Value</xsd:documentation>
510                                         <xsd:documentation source="CalculationsAndRules">This value must be greater than or
     equal to value in EfficiencyMinimumValue in section C; Else  flag as a non-compliant value and do not allow this document to be
     registered.</xsd:documentation>
511                                      </xsd:annotation>
512                                      <xsd:element name="E03_EfficiencyInstalledValueSEER" type="
     hvac:EfficiencyInstalledValueSEER"/>
513                                      <xsd:element name="E03_EfficiencyInstalledValueEER" type="
     hvac:EfficiencyInstalledValueEER">
514                                         <xsd:annotation>
515                                            <xsd:documentation source="FieldText">Cooling Efficiency Value</xsd:documentation>
516                                            <xsd:documentation source="CalculationsAndRules">This value must be greater than or
     equal to value in EfficiencyMinimumValue in section C; Else  flag as a non-compliant value and do not allow this document to be
     registered.</xsd:documentation>
517                                         </xsd:annotation>
518                                      </xsd:element>
519                                   </xsd:choice>
520                                   <xsd:choice maxOccurs="1">
521                                      <xsd:annotation>
522                                         <xsd:documentation source="FieldText">Condenser or Package Unit Manufacturer</
     xsd:documentation>
523                                      </xsd:annotation>
524                                      <xsd:element name="E04_CondenserManufacturer" type="comp:CondenserManufacturer"/>
525                                      <xsd:element name="E04_PackageUnitManufacturer" type="comp:PackageUnitManufacturer">
526                                         <xsd:annotation>
527                                            <xsd:documentation source="FieldText">Condenser or Package Unit Manufacturer</
     xsd:documentation>
528                                         </xsd:annotation>
529                                      </xsd:element>
530                                   </xsd:choice>
```

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531                                 <xsd:choice maxOccurs="1">
532                                    <xsd:annotation>
533                                       <xsd:documentation source="FieldText">Condenser or Package Unit Model Number</
xsd:documentation>
534                                    </xsd:annotation>
535                                    <xsd:element name="E05_CondenserModelNumber" type="comp:CondenserModelNumber"/>
536                                    <xsd:element name="E05_PackageUnitModelNumber" type="comp:PackageUnitModelNumber">
537                                       <xsd:annotation>
538                                          <xsd:documentation source="FieldText">Condenser or Package Unit Model Number</
xsd:documentation>
539                                       </xsd:annotation>
540                                    </xsd:element>
541                                 </xsd:choice>
542                                 <xsd:choice maxOccurs="1">
543                                    <xsd:annotation>
544                                       <xsd:documentation source="FieldText">Condenser or Package Unit Serial Number</
xsd:documentation>
545                                    </xsd:annotation>
546                                    <xsd:element name="E06_CondenserSerialNumber" type="comp:CondenserSerialNumber"/>
547                                    <xsd:element name="E06_PackageUnitSerialNumber" type="comp:PackageUnitSerialNumber">
548                                       <xsd:annotation>
549                                          <xsd:documentation source="FieldText">Condenser or Package Unit Serial Number</
xsd:documentation>
550                                       </xsd:annotation>
551                                    </xsd:element>
552                                 </xsd:choice>
553                                 <xsd:element name="E07_CoolingEquipmentRatedCapacity" type="
hvac:CoolingEquipmentRatedCapacity">
554                                    <xsd:annotation>
555                                       <xsd:documentation source="FieldText">System Rated  Cooling Capacity at Design
Conditions (Btu/hr)</xsd:documentation>
556                                    </xsd:annotation>
557                                 </xsd:element>
558                                 <xsd:element name="E08_CondenserNominalCoolingCapacity" type="
hvac:CondenserNominalCoolingCapacity">
559                                    <xsd:annotation>
560                                       <xsd:documentation source="FieldText">Condenser Rated Nominal Capacity (ton)</
xsd:documentation>
561                                    </xsd:annotation>
562                                 </xsd:element>
563                              </xsd:sequence>
564                           </xsd:complexType>
565                        </xsd:element>
566                     </xsd:sequence>
567                  </xsd:complexType>
568               </xsd:element>
569               <xsd:element name="EEndNote1_SectionComments" type="comp:SectionComments" minOccurs="0">
570                  <xsd:annotation>
571                     <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
572                     <xsd:documentation source="AdditionalRequirements">Notes:</xsd:documentation>
573                  </xsd:annotation>
574               </xsd:element>
575            </xsd:sequence>
576         </xsd:complexType>
577      </xsd:element>
578      <xsd:element name="Section_F" minOccurs="0">
579         <xsd:annotation>
580            <xsd:documentation source="FieldText">Extension of Existing Duct System, Greater Than 40 Feet</
xsd:documentation>
581            <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  one or more systems in
section B has  ResidentialHvacAlterationType equal to DuctSystemExtended; Require one row of data to be entered for each of
these systems.</xsd:documentation>
582            <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
statement 'This section does not apply to this project.'</xsd:documentation>
583         </xsd:annotation>
584         <xsd:complexType>
585            <xsd:sequence>
586               <xsd:element name="Table5">
```

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587                     <xsd:complexType>
588                       <xsd:sequence>
589                         <xsd:element name="Row" maxOccurs="unbounded">
590                           <xsd:complexType>
591                             <xsd:sequence>
592                               <xsd:element name="F01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
593                                 <xsd:annotation>
594                                   <xsd:documentation source="FieldText">System Identification or Name</xsd:documentation>
595                                   <xsd:documentation source="CalculationsAndRules">Reference to one of the
    ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
596                                 </xsd:annotation>
597                               </xsd:element>
598                               <xsd:element name="F02_DuctRValue" type="hvac:DuctRValue">
599                                 <xsd:annotation>
600                                   <xsd:documentation source="FieldText">New Duct R-Value</xsd:documentation>
601                                   <xsd:documentation source="CalculationsAndRules">To comply, the entered DuctRValue
602 must be greater or equal to the  DuctRValueLimit value in section C; Else  flag as a non-compliant value and report in project
    status notes field; a revised CF1R or revised installation may be required</xsd:documentation>
603                                 </xsd:annotation>
604                               </xsd:element>
605                             </xsd:sequence>
606                           </xsd:complexType>
607                         </xsd:element>
608                       </xsd:sequence>
609                     </xsd:complexType>
610                   </xsd:element>
611                 </xsd:sequence>
612               </xsd:complexType>
613             </xsd:element>
614             <xsd:element name="Section_G" minOccurs="0" maxOccurs="1">
615               <xsd:annotation>
616                 <xsd:documentation source="FieldText">Installed Duct System Information</xsd:documentation>
617                 <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  one or more systems in
    section B has  a true value in either DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced or
    AllNewOrReplacedHvacSystem.  Require one row of data to be entered for each of these systems.</xsd:documentation>
618                 <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
    statement 'This section does not apply to this project.'</xsd:documentation>
619               </xsd:annotation>
620               <xsd:complexType>
621                 <xsd:sequence>
622                   <xsd:element name="Table6">
623                     <xsd:complexType>
624                       <xsd:sequence>
625                         <xsd:element name="Row" maxOccurs="unbounded">
626                           <xsd:complexType>
627                             <xsd:sequence>
628                               <xsd:element name="G01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
629                                 <xsd:annotation>
630                                   <xsd:documentation source="FieldText">SC System Identification or Name</
    xsd:documentation>
631                                   <xsd:documentation source="CalculationsAndRules">Reference to one of the
    ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
632                                 </xsd:annotation>
633                               </xsd:element>
634                               <xsd:element name="G02_ResidentialHvacSystemAreaServed" type="
    hvac:ResidentialHvacSystemAreaServed">
635                                 <xsd:annotation>
636                                   <xsd:documentation source="FieldText">SC System Location or Area Served</
    xsd:documentation>
637                                   <xsd:documentation source="CalculationsAndRules">From section B  the
    ResidentialHvacSystemAreaServed for this system</xsd:documentation>
638                                 </xsd:annotation>
639                               </xsd:element>
640                               <xsd:element name="G03_SupplyDuctLocation" type="hvac:SupplyDuctLocation">
641                                 <xsd:annotation>
642                                   <xsd:documentation source="FieldText">Supply Duct Location</xsd:documentation>
```

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643                                 </xsd:annotation>
644                               </xsd:element>
645                               <xsd:element name="G04_DuctRValue" type="hvac:DuctRValue">
646                                 <xsd:annotation>
647                                   <xsd:documentation source="FieldText">Supply Duct R-Value</xsd:documentation>
648                                   <xsd:documentation source="CalculationsAndRules">Supply Duct DuctRValue must be
    greater than or equal to DuctRValueLimit value in section C to comply; Else flag it as non-compliant value and report in project
    status notes field; a revised CF1R or revised installation may be required</xsd:documentation>
649                                 </xsd:annotation>
650                               </xsd:element>
651                               <xsd:element name="G05_ReturnDuctLocation" type="hvac:ReturnDuctLocation">
652                                 <xsd:annotation>
653                                   <xsd:documentation source="FieldText">Return Duct Location</xsd:documentation>
654                                 </xsd:annotation>
655                               </xsd:element>
656                               <xsd:element name="G06_DuctRValue" type="hvac:DuctRValue">
657                                 <xsd:annotation>
658                                   <xsd:documentation source="FieldText">Return Duct R-Value</xsd:documentation>
659                                   <xsd:documentation source="CalculationsAndRules">Return Duct DuctRValue must be
    greater than or equal to DuctRValueLimit value in section C to comply; Else flag it as non-compliant value and report in project
    status notes field; a revised CF1R or revised installation may be required</xsd:documentation>
660                                 </xsd:annotation>
661                               </xsd:element>
662                               <xsd:element name="G07_DuctFilterGrilleSizingComplianceMethod" type="
    comp:DuctFilterGrilleSizingComplianceMethod">
663                                 <xsd:annotation>
664                                   <xsd:documentation source="FieldText">Method of compliance with duct and filter grille
    sizing requirements in 150.0(m)13</xsd:documentation>
665                                   <xsd:documentation source="CalculationsAndRules">If ResidentialCoolingSystemType =
    NoCooling Then result is SystemExempt, display text, System is Exempt;  Else If ResidentialCoolingSystemType =
    EvaporativeDirect, or EvaporativeIndirect, or EvaporativeIndirectDirect, Then report  result is SystemExempt, display text,
    System is Exempt; Else If B09 AllNewOrReplacedHvacSystem equals true and C13 IsVentilationSystemCFI is true then result
    is HERS_FanEfficacyAirflowRateNewReplace display text, HERS verified fan efficacy (W/cfm) and airflow rate (cfm/ton);  Else
    let user select  from remaining choices: HERS_FanEfficacyAirflowRateNewReplace display text, HERS Verified Fan Efficacy
    (W/cfm) And Airflow Rate (cfm/ton) or HERS_ReturnDuctDesignTable150BC display text, HERS Verified Return Duct Design
    per Table 150 B and C</xsd:documentation>
666                                 </xsd:annotation>
667                               </xsd:element>
668                               <xsd:element name="G08_DuctSystemAirFilterDeviceCount" type="
    hvac:DuctSystemAirFilterDeviceCount">
669                                 <xsd:annotation>
670                                   <xsd:documentation source="FieldText">Number of Air Filter Devices on System</
    xsd:documentation>
671                                 </xsd:annotation>
672                               </xsd:element>
673                             </xsd:sequence>
674                           </xsd:complexType>
675                         </xsd:element>
676                       </xsd:sequence>
677                     </xsd:complexType>
678                   </xsd:element>
679                   <xsd:element name="GEndNote1_SectionComments" type="comp:SectionComments" minOccurs="0">
680                     <xsd:annotation>
681                       <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
682                       <xsd:documentation source="AdditionalRequirements">Notes:</xsd:documentation>
683                     </xsd:annotation>
684                   </xsd:element>
685                 </xsd:sequence>
686               </xsd:complexType>
687             </xsd:element>
688             <xsd:element name="Section_H" minOccurs="0" maxOccurs="1">
689               <xsd:annotation>
690                 <xsd:documentation source="FieldText">Installed Air Filter Device Information</xsd:documentation>
691                 <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  at least one SC System
    listed in Section B has B08,  DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced or B09
    AllNewOrReplacedHvacSystem equal to true.</xsd:documentation>
692                 <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
    statement 'This section does not apply to this project.'</xsd:documentation>
```

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693             </xsd:annotation>
694             <xsd:complexType>
695                <xsd:sequence>
696                   <xsd:element name="Table7">
697                      <xsd:complexType>
698                         <xsd:sequence>
699                            <xsd:element name="Row" maxOccurs="unbounded">
700                               <xsd:complexType>
701                                  <xsd:sequence>
702                                     <xsd:element name="H01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
703                                        <xsd:annotation>
704                                           <xsd:documentation source="FieldText">SC System Identification or Name</
    xsd:documentation>
705                                           <xsd:documentation source="CalculationsAndRules">Reference to one of the
    ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
706                                        </xsd:annotation>
707                                     </xsd:element>
708                                     <xsd:element name="H02_ResidentialHvacSystemAreaServed" type="
    hvac:ResidentialHvacSystemAreaServed">
709                                        <xsd:annotation>
710                                           <xsd:documentation source="FieldText">SC System Location or Area Served</
    xsd:documentation>
711                                           <xsd:documentation source="CalculationsAndRules">From section B the
    ResidentialHvacSystemAreaServed for this system</xsd:documentation>
712                                        </xsd:annotation>
713                                     </xsd:element>
714                                     <xsd:element name="H03_DuctSystemAirFilterDeviceName" type="
    hvac:DuctSystemAirFilterDeviceName">
715                                        <xsd:annotation>
716                                           <xsd:documentation source="FieldText">Air Filter Device Identification or Name</
    xsd:documentation>
717                                        </xsd:annotation>
718                                     </xsd:element>
719                                     <xsd:element name="H04_DuctSystemAirFilterDeviceType" type="
    hvac:DuctSystemAirFilterDeviceType">
720                                        <xsd:annotation>
721                                           <xsd:documentation source="FieldText">Air Filter Device Type</xsd:documentation>
722                                        </xsd:annotation>
723                                     </xsd:element>
724                                     <xsd:element name="H05_DuctSystemAirFilterDeviceLocation" type="
    hvac:DuctSystemAirFilterDeviceLocation">
725                                        <xsd:annotation>
726                                           <xsd:documentation source="FieldText">Air Filter Device Location</xsd:documentation>
727                                        </xsd:annotation>
728                                     </xsd:element>
729                                     <xsd:element name="H06_AirFilterDeviceAirflowRate" type="hvac:AirFilterDeviceAirflowRate">
730                                        <xsd:annotation>
731                                           <xsd:documentation source="FieldText">Determined Design Airflow Rate for Air Filter Device
    (cfm)</xsd:documentation>
732                                        </xsd:annotation>
733                                     </xsd:element>
734                                     <xsd:element name="H07_DuctSystemAirFilterDevicePressureDrop" type="
    hvac:DuctSystemAirFilterDevicePressureDrop">
735                                        <xsd:annotation>
736                                           <xsd:documentation source="FieldText">Determined Design Allowable Pressure Drop for Air
    Filter Device (inch W.C.)</xsd:documentation>
737                                        </xsd:annotation>
738                                     </xsd:element>
739                                  </xsd:sequence>
740                               </xsd:complexType>
741                            </xsd:element>
742                         </xsd:sequence>
743                      </xsd:complexType>
744                   </xsd:element>
745                   <xsd:element name="HEndNote1_SectionComments" type="comp:SectionComments" minOccurs="0">
746                      <xsd:annotation>
747                         <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
```

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748                     <xsd:documentation source="AdditionalRequirements">Notes:</xsd:documentation>
749                   </xsd:annotation>
750                 </xsd:element>
751               </xsd:sequence>
752             </xsd:complexType>
753           </xsd:element>
754           <xsd:element name="Section_I" minOccurs="0" maxOccurs="1">
755             <xsd:annotation>
756               <xsd:documentation source="FieldText">Air Filter Device Requirements</xsd:documentation>
757               <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  at least one SC System
    listed in Section B has B08,  DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced or B09
    AllNewOrReplacedHvacSystem equal to true.</xsd:documentation>
758               <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the
    statement 'This section does not apply to this project.'</xsd:documentation>
759             </xsd:annotation>
760             <xsd:complexType>
761               <xsd:sequence>
762                 <xsd:element name="I01" minOccurs="0">
763                   <xsd:annotation>
764                     <xsd:documentation source="FieldText">Recirculated and outdoor air filtering</xsd:documentation>
765                     <xsd:documentation source="AdditionalRequirements">The system shall be designed to ensure that all
    recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through the system's thermal
    conditioning components.</xsd:documentation>
766                   </xsd:annotation>
767                 </xsd:element>
768                 <xsd:element name="I02" minOccurs="0">
769                   <xsd:annotation>
770                     <xsd:documentation source="FieldText">Air Filter Device Requirements</xsd:documentation>
771                     <xsd:documentation source="AdditionalRequirements">The system shall be designed to accommodate the
    clean-filter pressure drop imposed by the system air filter device(s). The design airflow rate and maximum allowable clean-filter
    pressure drop at the design airflow rate applicable to each air filter device shall be determined, and all system air filter device
    locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop.
    The labels shall be permanently affixed to the air filter device, readily legible, and visible to a person replacing the air filter
    media, and the air filter devices shall be provided with air filter media that conforms to these determined or  labeled maximum
    allowable clean-filter pressure drop values as rated using AHRI Standard 680.</xsd:documentation>
772                   </xsd:annotation>
773                 </xsd:element>
774                 <xsd:element name="I03" minOccurs="0">
775                   <xsd:annotation>
776                     <xsd:documentation source="FieldText">Air filter access and regular service</xsd:documentation>
777                     <xsd:documentation source="AdditionalRequirements">All system air filter devices shall be located and
    installed in such a manner as to allow access and regular service by the system owner.</xsd:documentation>
778                   </xsd:annotation>
779                 </xsd:element>
780                 <xsd:element name="I04" minOccurs="0">
781                   <xsd:annotation>
782                     <xsd:documentation source="FieldText">Air filter media efficiency</xsd:documentation>
783                     <xsd:documentation source="AdditionalRequirements">The system shall be provided with air filter media
    having a designated efficiency equal to or greater than MERV 6 when tested in accordance with ASHRAE Standard 52.2, or a
    particle size efficiency rating equal to or greater than 50 percent in the 3.0 to10 micron range when tested in accordance with
    AHRI Standard 680.</xsd:documentation>
784                   </xsd:annotation>
785                 </xsd:element>
786                 <xsd:element name="I05" minOccurs="0">
787                   <xsd:annotation>
788                     <xsd:documentation source="FieldText">Air filter media manufacturer label</xsd:documentation>
789                     <xsd:documentation source="AdditionalRequirements">The system shall be provided with air filter media
    that has been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that conform to the required
    efficiency and pressure drop requirements for the air filter device.</xsd:documentation>
790                   </xsd:annotation>
791                 </xsd:element>
792                 <xsd:element name="IEndNote1" minOccurs="0">
793                   <xsd:annotation>
794                     <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
795                     <xsd:documentation source="AdditionalRequirements">The responsible persons signature on this
    compliance document affirms that all applicable requirements in this table have been met.</xsd:documentation>
796                   </xsd:annotation>
797                 </xsd:element>
```

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798                </xsd:sequence>
799             </xsd:complexType>
800          </xsd:element>
801          <xsd:element name="Section_J" minOccurs="1" maxOccurs="1">
802             <xsd:annotation>
803                <xsd:documentation source="FieldText">HERS Verification Requirements</xsd:documentation>
804                <xsd:documentation source="CalculationsAndRules">Require one row of data in this table for each of the SC
    Systems listed in Section C</xsd:documentation>
805                <xsd:documentation source="MinOccurs">This section is required.</xsd:documentation>
806             </xsd:annotation>
807             <xsd:complexType>
808                <xsd:sequence>
809                   <xsd:element name="Table8">
810                      <xsd:complexType>
811                         <xsd:sequence>
812                            <xsd:element name="Row" maxOccurs="unbounded">
813                               <xsd:complexType>
814                                  <xsd:sequence>
815                                     <xsd:element name="J01_ResidentialSpaceConditioningSystemName" type="
    hvac:ResidentialSpaceConditioningSystemName">
816                                        <xsd:annotation>
817                                           <xsd:documentation source="FieldText">SC System Identification or Name</
    xsd:documentation>
818                                           <xsd:documentation source="CalculationsAndRules">Reference to one of the
    ResidentialSpaceConditioningSystemName listed in section B</xsd:documentation>
819                                        </xsd:annotation>
820                                     </xsd:element>
821                                     <xsd:element name="J02_ResidentialHvacSystemAreaServed" type="
    hvac:ResidentialHvacSystemAreaServed">
822                                        <xsd:annotation>
823                                           <xsd:documentation source="FieldText">SC System Location or Area Served</
    xsd:documentation>
824                                           <xsd:documentation source="CalculationsAndRules">From section B  the
    ResidentialHvacSystemAreaServed for this system</xsd:documentation>
825                                        </xsd:annotation>
826                                     </xsd:element>
827                                     <xsd:element name="J03_DuctLeakageTestExemption" type="comp:DuctLeakageTestExemption">
828                                        <xsd:annotation>
829                                           <xsd:documentation source="FieldText">Exemption From Duct Leakage Requirements</
    xsd:documentation>
830                                           <xsd:documentation source="CalculationsAndRules">If B04 DuctedSystem is false, Then
    result is N/A; Else default Value for DuctLeakageTestExemption is NoExemptions;  Allow user to override the default and select
    one of the possible exemptions. For choice DuctsSealedTested_HERSCertified display text: Ducts have previously been sealed,
    tested, and certified by a HERS rater.  For choice DuctLessThan40FeetInUnconditionedSpaces display text: Duct system has
    less than 40 ft of duct in unconditioned spaces.  For choice DuctSystemAsbestos display text: Duct system is insulated or
    sealed with asbestos.  Flag non-default values and report in project status notes field; The enforcement agency may require
    additional documentation as validation.</xsd:documentation>
831                                        </xsd:annotation>
832                                     </xsd:element>
833                                     <xsd:element name="J04_DuctLeakageTestRequired" type="comp:DuctLeakageTestRequired">
834                                        <xsd:annotation>
835                                           <xsd:documentation source="FieldText">MCH20  Duct Leakage Test</xsd:documentation>
836                                           <xsd:documentation source="CalculationsAndRules">Display Yes and No to represent
    Boolean result values true and false.  Calculation: If B04 DuctedSystem equals false Then result is false;  Else If J03
    DuctLeakageTestExemption equals N/A then result is false;  ElseIf  J03 DuctLeakageTestExemption doesn't equal
    NoExemptions Then result is false; Else determine the  result for this field by the user responses in B04, B05 , B06, B07, B08,
    B09 and use of Logic Table for Determining Alteration Type and HERS Verification Requirements. In the logic table If the term
    DctLk appears in the HERS column, Then result is true (duct leakage test required);
837 Else If DctLk does not appear in the HERS column, then result is false.</xsd:documentation>
838                                        </xsd:annotation>
839                                     </xsd:element>
840                                     <xsd:choice maxOccurs="1">
841                                        <xsd:annotation>
842                                           <xsd:documentation source="FieldText">Exemption from Minimum R-Value for Ducts In
    Conditioned Space</xsd:documentation>
843                                           <xsd:documentation source="CalculationsAndRules">If B04 DuctedSystem is false, OR C11
    DuctExtendedLengthRange equals N/A then result is N/A stored in the NotApplicableMessage; Else default value is false  stored
    in DuctsInConditionedSpaceRValueException with display text: No Exemption.  Allow user to override the default and select
```

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jim\Work Yes, stored as true in DuctsInConditionedSpaceRValueException</xsd:documentation>
844                                 </xsd:annotation>
845                                 <xsd:element name="J05_DuctsInConditionedSpaceRValueException" type="
    comp:DuctsInConditionedSpaceRValueException"/>
846                                 <xsd:element name="J05_NotApplicableMessage" type="comp:NotApplicableMessage">
847                                    <xsd:annotation>
848                                       <xsd:documentation source="FieldText">Exemption from Minimum R-Value for Ducts In
    Conditioned Space</xsd:documentation>
849                                       <xsd:documentation source="CalculationsAndRules">If B04 DuctedSystem is false, OR
    C11 DuctExtendedLengthRange equals N/A then result is N/A stored in the NotApplicableMessage; Else default value is false
    stored in DuctsInConditionedSpaceRValueException with display text: No Exemption.  Allow user to override the default and
    select Yes, stored as true in DuctsInConditionedSpaceRValueException</xsd:documentation>
850                                    </xsd:annotation>
851                                 </xsd:element>
852                              </xsd:choice>
853                              <xsd:element name="J06_DuctsInConditionedSpaceVerification" type="
    comp:DuctsInConditionedSpaceVerification">
854                                 <xsd:annotation>
855                                    <xsd:documentation source="FieldText">MCH21 Ducts Located In Cond Space Verification</
    xsd:documentation>
856                                    <xsd:documentation source="CalculationsAndRules">Display Yes and No to represent
    Boolean values true and false.  Calculation:  If DuctsInConditionedSpaceRValueException = true And If  Supply Duct
    DuctRValue  Or Return Duct DuctRValue in section G Or New Duct DuctRValue in section F is less than DuctRValueLimit in
    section C, result is true; Else result is false.</xsd:documentation>
857                                 </xsd:annotation>
858                              </xsd:element>
859                              <xsd:element name="J07_AHU_FanEfficacyVerificationRequired" type="
    comp:AHU_FanEfficacyVerificationRequired">
860                                 <xsd:annotation>
861                                    <xsd:documentation source="FieldText">MCH22 AHU Fan Efficacy (W per cfm)</
    xsd:documentation>
862                                    <xsd:documentation source="CalculationsAndRules">Display Yes and No to represent
    Boolean values true and false. If B04 DuctedSystem is false, result is false; Else If C13=CFI System, then  result is true;  Else If
    DuctFilterGrilleSizingComplianceMethod in section G equals HERS Verified Fan Efficacy And Airflow Rate Then result is true;
    Else If B09 AllNewOrReplacedHvacSystem equals true And C06 ResidentialCoolingSystemType equals NoCooling  And C13
    IsVentialationSystemCFI is true, then result is true;  Else result is false.</xsd:documentation>
863                                 </xsd:annotation>
864                              </xsd:element>
865                              <xsd:element name="J08_AHU_AirflowRateVerificationRequired" type="
    comp:AHU_AirflowRateVerificationRequired">
866                                 <xsd:annotation>
867                                    <xsd:documentation source="FieldText">MCH23 AHU Airflow Rate (cfm per ton)</
    xsd:documentation>
868                                    <xsd:documentation source="CalculationsAndRules">Display text Yes and No to represent
    Boolean values true and false.  If DuctedSystem in B04 is false then result is false,  Else If C13=CFI System, then  result is
    true;   Else If DuctFilterGrilleSizingComplianceMethod in section G equals HERS Verified Fan Efficacy And Airflow Rate then
    result is true;  Else If RefrigerantChargeVerificationRequired in J09 equals true And ReturnDuctDesignVerificationRequired in
    J10 equals false; Then result is true;  Else If B09 AllNewOrReplacedHvacSystem equals true And C06
    ResidentialCoolingSystemType equals NoCooling  And C13 IsVentialationSystemCFI is true, then result is true;  Else result is
    false.</xsd:documentation>
869                                 </xsd:annotation>
870                              </xsd:element>
871                              <xsd:element name="J09_RefrigerantChargeVerificationRequired" type="
    comp:RefrigerantChargeVerificationRequired">
872                                 <xsd:annotation>
873                                    <xsd:documentation source="FieldText">MCH25 Refrigerant Charge</xsd:documentation>
874                                    <xsd:documentation source="CalculationsAndRules">Display Yes and No to represent
    Boolean values true and false.  Calculation based user responses in section B B04, B05 , B06, B07, B08, B09 and use of Logic
    Table for Determining Alteration Type and HERS Verification Requirements.for Section B (inserted below section B); constrain
    user input for fields B04-B09 to allow only the available combinations of responses given in the Logic Table in rows a through
    q;    In the logic table:   If RC appears in the HERS column  and If ClimateZone in section A equals 2, 8,9,10,11,12,13,14,or 15
    Then result is true; Else result is false.</xsd:documentation>
875                                 </xsd:annotation>
876                              </xsd:element>
877                              <xsd:element name="J10_ReturnDuctDesignVerificationRequired" type="
    comp:ReturnDuctDesignVerificationRequired">
878                                 <xsd:annotation>
879                                    <xsd:documentation source="FieldText">MCH28 Return Duct Design Table 150.0-B or C</
```

```
xsd:documentation>
                                    <xsd:documentation source="CalculationsAndRules">Display Yes and No to represent Boolean values true and false.  If DuctedSystem in B04 is false then result is false, Else If DuctFilterGrilleSizingComplianceMethod in section G equals HERS_ReturnDuctDesignTable150BC Then result is true;  Else the result is false.</xsd:documentation>
                                    </xsd:annotation>
                                  </xsd:element>
                                </xsd:sequence>
                              </xsd:complexType>
                            </xsd:element>
                          </xsd:sequence>
                        </xsd:complexType>
                      </xsd:element>
                      <xsd:element name="JEndNote1_SectionComments" type="comp:SectionComments" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Notes:</xsd:documentation>
                        </xsd:annotation>
                      </xsd:element>
                    </xsd:sequence>
                  </xsd:complexType>
                </xsd:element>
                <xsd:element name="Section_K" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Space Conditioning Systems, Ducts and Fans Mandatory Requirements and Additional Measures</xsd:documentation>
                    <xsd:documentation source="MinOccurs">If this section doesn't apply, display only the section FieldText and the statement 'This section does not apply to this project.'</xsd:documentation>
                  </xsd:annotation>
                  <xsd:complexType>
                    <xsd:sequence>
                      <xsd:element name="K_BeginNote1" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">Begin Note 1</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Note:  Additional mandatory requirements from Section 150.0 that are not listed here may be applicable to some systems.  These requirements may be applicable to only newly installed equipment or portions of the system that are altered.  Existing equipment may be exempt from these requirements.</xsd:documentation>
                        </xsd:annotation>
                      </xsd:element>
                      <xsd:element name="K00" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">Subheading</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Heating Equipment</xsd:documentation>
                        </xsd:annotation>
                      </xsd:element>
                      <xsd:element name="K01" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">Equipment Efficiency</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Equipment Efficiency: All heating equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.</xsd:documentation>
                        </xsd:annotation>
                      </xsd:element>
                      <xsd:element name="K02" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">Controls</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Controls:  All unitary heating systems, including heat pumps, must be controlled by a setback thermostat.  These thermostats must be capable of allowing the occupant to program the temperature set points for at least four different periods in 24 hours. See Sections 150.0(i), 110.2(b).</xsd:documentation>
                        </xsd:annotation>
                      </xsd:element>
                      <xsd:element name="K03" minOccurs="0">
                        <xsd:annotation>
                          <xsd:documentation source="FieldText">Sizing:</xsd:documentation>
                          <xsd:documentation source="AdditionalRequirements">Sizing:  Heating load calculations must be done on portions of the building served by new heating systems to prevent inadvertent undersizing or oversizing. See sections 150.0(h)1
```

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and 2).</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K04" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Furnace Temperature Rise</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Furnace Temperature Rise: Central forced-air heating furnace installations must be configured to operate at or below the furnace manufacturer's maximum inlet-to-outlet temperature rise specification. See Section 150.0(h)4.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K05" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Standby Losses and Pilot Lights</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Standby Losses and Pilot Lights: Fan-type central furnaces may not have a continuously burning pilot light. Section 110.5 and Section 110.2(d).</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K05After" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Subheading</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Cooling Equipment</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K06" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Equipment Efficiency:</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Equipment Efficiency:  All cooling equipment must meet the minimum efficiency requirements of Section 110.1 and Section 110.2(a) and the Appliance Efficiency Regulations.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K07" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Refrigerant Line Insulation</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Refrigerant Line Insulation:  All refrigerant line insulation in split system air conditioners and heat pumps must meet the R-value and protection requirements of Section 150.0(j)2 and 3, and Section 150.0(m)9.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K08" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Condensing Unit Location</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Condensing Unit Location:  Condensing units shall not be placed within five (5) feet of a dryer vent outlet. See Section 150.0(h)3A.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K09" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Liquid Line Filter Drier</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Liquid Line Filter Drier: If applicable, a liquid line filter drier shall be installed according to the manufacturer's specifications.  Section 150.0(h)3B</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K10" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Sizing</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Sizing: Cooling load calculations must be done on portions of the building served by new cooling systems to prevent inadvertent undersizing or oversizing. See Section 150.0(h)1 and 2.</xsd:documentation>
                    </xsd:annotation>
                </xsd:element>
                <xsd:element name="K10After" minOccurs="0">
                    <xsd:annotation>
                        <xsd:documentation source="FieldText">Subheading</xsd:documentation>
                        <xsd:documentation source="AdditionalRequirements">Air Distribution System Ducts, Plenums and Fans</xsd:documentation>
                    </xsd:annotation>
```

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                </xsd:element>
                <xsd:element name="K11" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Insulation</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">Insulation:  In all cases, unless ducts are enclosed entirely in directly conditioned space, the minimum duct insulation value is R-6. Note that higher values may be required by the prescriptive or performance requirements. See Section 150.0(m)1.</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K12" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Connections and Closures</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">Connections and Closures: All installed air-distribution system ducts and plenums must be, sealed and insulated to meet the requirements of CMC Sections 601.0, 602.0, 603.0, 604.0, 605.0 and ANSI/SMACNA-006-2006:  Supply-air and return-air ducts and plenums must be insulated to a minimum installed level of R-6.0 or enclosed entirely in directly conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K12After" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Subheading</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">Heat Pump Thermostat</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K13" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Requirements of Section 110.2(b) and (c)</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">A thermostat shall be installed that meets the requirements of Section 110.2(b) and Section 110.2(c).</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K14" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Manufacturers published installation specifications</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">The thermostat shall be installed in accordance with the manufacturers published installation specifications</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K15" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">First stage of heating</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">First stage of heating shall be assigned to heat pump heating.</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="K16" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">Second stage back up heating</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">Second stage back up heating shall be set to come on only when the indoor set temperature cannot be met.</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
                <xsd:element name="KEndNote1" minOccurs="0">
                  <xsd:annotation>
                    <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
                    <xsd:documentation source="AdditionalRequirements">The responsible person signature on this compliance document affirms that all applicable requirements in this table have been met.</xsd:documentation>
                  </xsd:annotation>
                </xsd:element>
              </xsd:sequence>
            </xsd:complexType>
          </xsd:element>
        </xsd:sequence>
      </xsd:complexType>
      <xsd:element name="cF2RMCH01bE" type="CF2RMCH01bE">
        <xsd:annotation>
```

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1044            <xsd:documentation>This element contains all of the data and text required to generate the CF2RMCH01bE compliance
report.</xsd:documentation>
1045          </xsd:annotation>
1046       </xsd:element>
1047    </xsd:schema>
1048
```