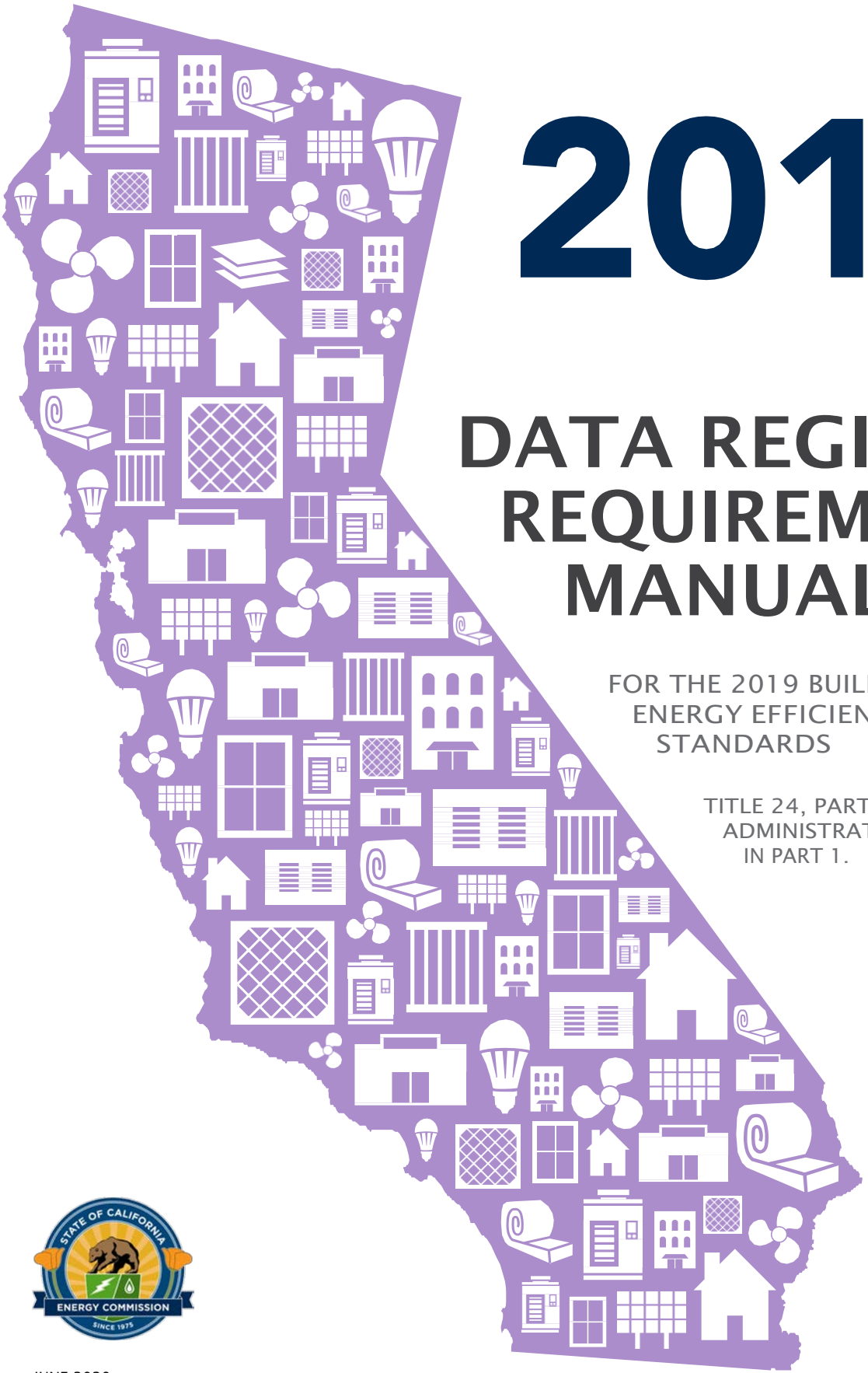

2019

DATA REGISTRY REQUIREMENTS MANUAL

FOR THE 2019 BUILDING ENERGY EFFICIENCY STANDARDS

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

JUNE 2020
CEC-400-2018-022-CMF

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ACKNOWLEDGMENTS

The Building Energy Efficiency Standards (Energy Standards) were first adopted and put into effect in 1978 and are updated periodically. The Energy 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 2019 Energy Standards development and adoption process continued that long-standing practice of maintaining Energy Standards with technical rigor, challenging but achievable design and construction practices, public engagement, and full consideration of stakeholder knowledge and opinions. The 2019 Energy 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 Maziar Shirakh, PE; Todd Ferris; Michael Shewmaker, Alexis Smith, Jeff Miller, PE; Ronald Balneg, and RJ Wichert. Other key technical staff contributors included Payam Bozorgchami, PE; Simon Lee; Rashid Mir, PE; Dee Anne Ross; Joe Loyer; Tav Commins; and Danny Tam. Christopher Meyer, Manager of the Building Standards Office, provided overall guidance to the staff and consultants. Efficiency Division Deputy Director Michael Sokol and Deputy Division Chief Christine Collopy provided policy guidance. Rebecca Westmore, Galen Lemei and Matt Chalmers provided expert legal counsel.

Special thanks to our key consultants Diane Pepetone and Robert Scott; and to the many Home Energy Rating System (HERS) Providers and HERS Rater stakeholders who contributed to the development and implementation of these Data Registry requirements.

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 Energy 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 Energy Standards requirements during the design, construction or installation, and field verification phases. However, unlike the Building Energy Efficiency Standards, compliance documents are not adopted regulation, but are approved by the Energy Commission to be used to demonstrate compliance with the Energy Standards. The significant difference being that while the Building Energy Efficiency Standards may only be substantially altered through the rulemaking process, the compliance documents may be altered and approved as needed. The *Data Registry Requirements Manual* (this manual), is a compliance document that is approved by the Energy Commission and is not considered regulation. The intent of this manual is to give a data registry provider a clear detailed description of the intended compliance with the Building Energy Efficiency Standards, Reference Joint Appendix 7.

The 2019 Energy 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 Extensible Markup Language (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.

Each data registry provider is required to submit an application for Energy Commission approval of their proposed Data Registry following the adoption of the Building Energy Efficiency Standards. 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* (DRRM) provides additional detailed information and explanations regarding the functional and technical aspects of the requirements given in *Reference Joint Appendix JA7*. This manual is intended as a resource for Data Registry Providers to aid in the design and implementation of software procedures and user interface features for their Data Registries that meet the requirements of *Reference Joint Appendix JA7*.

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.

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1 Introduction

1.1 Purpose and Scope

The *2019 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 (Energy 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 as a similar resource 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:

- *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2018-020-CMF*
- *2019 Reference Appendices for Residential and Nonresidential Buildings. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2018-021-CMF*
- *2019 Residential Alternative Calculation Method Reference Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2019-005-CMF*

- *2019 Nonresidential Alternative Calculation Method Reference Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2019-006-CMF*
- *2019 Residential Compliance Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2018-017-CMF*
- *2019 Nonresidential Compliance Manual. California Title 24, Part 6, and Associated Administrative Regulations in Part 1. CEC-400-2018-018-CMF*

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:

- 2019 Title 24, Part 1, Standards Section 10-102
- 2019 Title 24, Part 6, Standards Section 100.1
- 2019 Title 24, Part 6, Reference Joint Appendix JA1
- 2019 Title 24, Part 6, Reference Joint Appendix Section JA7.2

2 Standardized Data and Electronic Documents

2.1 Overview

The Building Energy Efficiency Standards (Energy 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 2019 Energy 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. Adobe Acrobat Portable Document Format (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 Energy Standards Section 10-103.

2.2 Report Generator (RG) Web Service

The RG receives standardized document data exchange files from Energy Commission-approved software applications and Data Registries 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 (CBECC-Res) compliance software and all third-party vendor users of CBECC-Res.
- CBECC Nonresidential (CBECC-Com) compliance software and all third-party vendor users of CBECC-Com.
- 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.

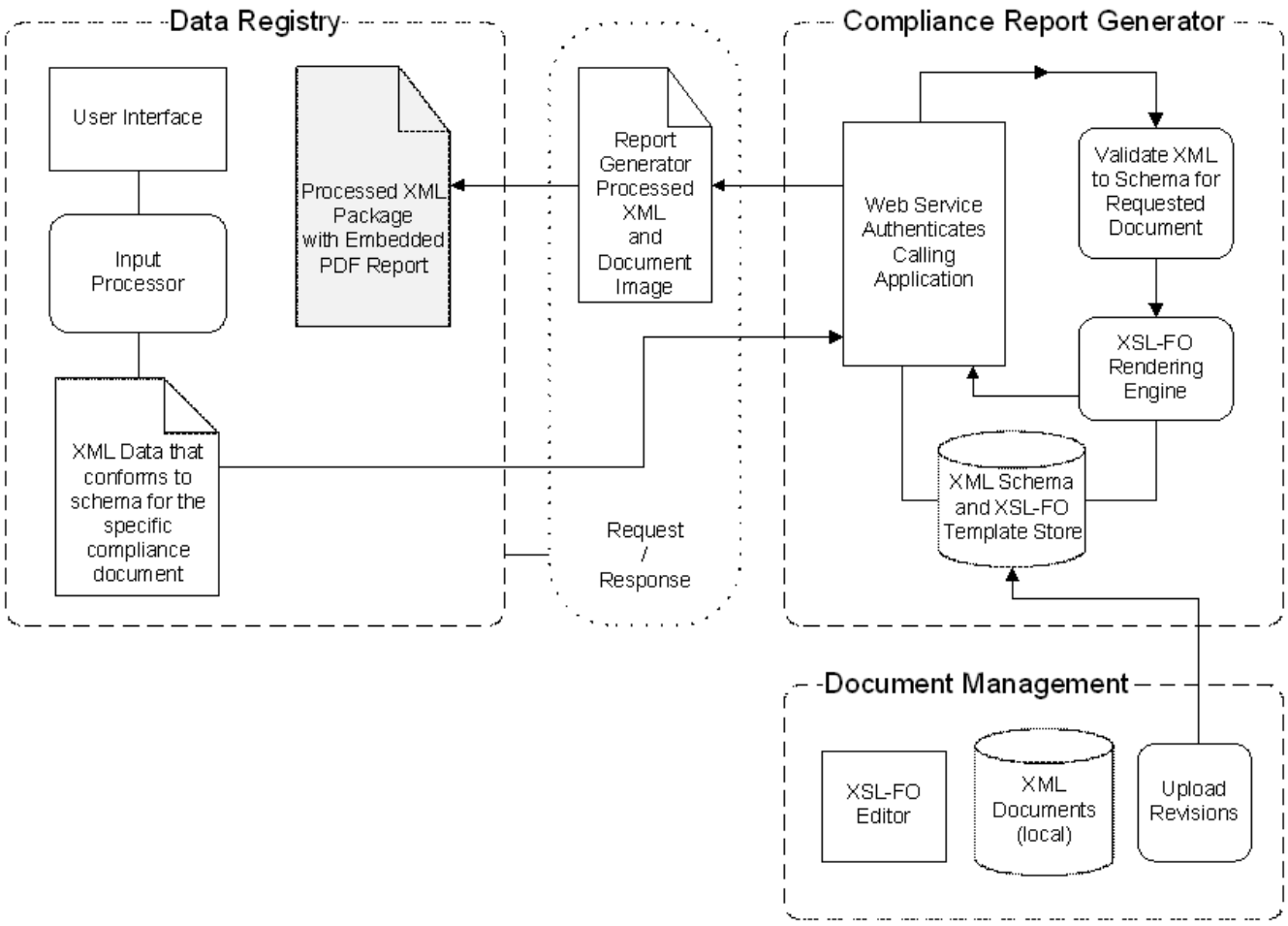
  Note: The requirement for registration of nonresidential compliance documents is contingent upon approval of Nonresidential Data Registry(s) by the Energy Commission as specified by Energy Standards Section 10-103.

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 RG 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 RG 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 RG



2.3 RG Versioning Procedures

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

- **RG 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 XML schema definition language (XSD) and Extensible Stylesheet language (XSL) files used by the RG prior to making the revised files available to the Data Registries.

- **RG 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.

- **RG 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 will 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. RG and Document Schema Version Numbering Convention

Text included in RG URL	Title 24 Energy Standards Version Year	RG and Schema Major Version Number	RG and Schema Minor Version Number
DocsV	2019	x	xxx

Examples:

DocsV2019.x.xxx

The numeric digits represented in the numbering convention should be sequential, beginning with DocsV2019.1.000 for the first major version, progressing through DocsV2019.1.999 for subsequent minor versions. For the second major version the numbering begins with DocsV2019.2.000 progressing through DocsV2019.2.999 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 Energy 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 RG 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 RG testing site for vetting by the Data Registries.

2.3.3 Version Testing Stage

Release of a new batch of revisions to the RG 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 RG testing site should also be accompanied by a commit of the revised files to the Energy Commission's repository, hosted at GitHub.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 RG 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 RG 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 DocsV2019.1.000 follows:

https://beesreporting.energy.ca.gov/DataRegistryTest**DocsV2019.1.000**/DRReportingService.svc/

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

https://beesreporting.energy.ca.gov/DataRegistryTest**DocsV2019.1.001**/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 RG testing site and

also committed to the Energy Commission 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 RG production site.

2.3.4 Version Deployment to Production Stage

Release of a new batch of revisions to the RG 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 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 RG 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 RG 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, 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 site. At this stage work may have begun on updating the XSL documents, so there may be significant negative impacts if changes are made to the completed files included in the batch for the versioning procedure. At this point the new schema version is "locked in," but the new version 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 contained in the new 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 site and are available to the Data Registry Providers to use. 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 or a very low disruptiveness, 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 RG. 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 RG, 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 RG 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 RG 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 RG 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 RG software:

a. XML data file(s) that were sent to the RG 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 RG 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 RG software must be backward compatible. If the resolution requires a revision that is not backward compatible, the RG 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 RG 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 RG 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 RG 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 RG software must be backward compatible. If the issue resolution requires a revision that is not backward compatible, the RG 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 2019 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 file repository hosted at GitHub.com at the following URL:

https://github.com/california-energy-commission/2019-HERS-Documents-Schema/tree/master/CEC-Documents

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 repository for reference by Data Registry technical staff. The Energy Commission project manager may grant access to view the contents of the file repository to persons other than Data Registry Provider staff to enable relevant activities such as Energy Standards stakeholder education materials preparation, and Energy Standards update reviews. If needed, previous versions of a compliance document design file can be recalled for viewing using the 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 2019 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 GitHub.com at the following URL:

https://github.com/california-energy-commission/2019-HERS-Documents-Schema/tree/master/deployed/schema

The schema files provide the basis for determining whether data submitted to the RG for production of 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. 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. Therefore, 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. They 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 the 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 2019 RG - 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 RG, 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. The Data Registry of Provider A implements V1.001 changes and submits a valid XML file that includes the change to the RG, which validates against V1.001. The RG then loads “V1.001” into the Payload attribute ComplianceDocumentSchemaVersion.

f. The Data Registry of 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 RG which also

validates against V1.001 and the RG 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 and/or a very low disruptiveness, 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 RG which validates against the new version, V2.000. The RG 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 RG and the XML files validate successfully against the new version, V2.000 and the RG 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 RG 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 RG software. A repository containing the XSL template files is available for use by authorized Energy Commission staff and technical consultants in charge of the RG 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 while logged into the Data Registry using their username and password. Subsequently the Data Registry adds an image representing the registration signer's 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 appends the Data Registry Provider's digital signature appearance 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, has been verified as complete by the Data Registry, and has completed the registration process such that that the document displays all applicable electronic signatures as well as the Provider's digital signature appearance and the document's unique registration number. The PDF image of the registered document is accessible for printing or viewing by authorized users of the Registry via the Registration Provider’s internet website.

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. A listing of the document configuration rules applicable to specific compliance document types and HERS verification features is presented in Table 6-1.

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.	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. Required as prerequisite to registration of a CF1R-PRF for an altered dwelling.

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 Energy Standards requirement.

Example: For compliance with the refrigerant charge verification requirements in Energy 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 Energy 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 E03 on the 2019-CF2R-MCH-25b:

03	System Airflow Rate Verification Status	<<if the CF2R-MCH-01 indicates a MCH-28 is required for alternate 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 E02, then result = **System complies with minimum airflow rate requirements**; elseif A10=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 RA3.3.3.1.5**. **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)>>

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

A Data Registry is expected to implement data security and authentication for processing of the Performance Certificate of Compliance Registration Package (registration package) data exchange between the Compliance Software, RG, 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 RG. 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 RG would make any such tampering known to the Data Registry. The RG embeds a PDF-formatted Certificate of Compliance document into a registration package as Base-64 ASCII data. When a registration package contains encoded PDF data originating from an approved RG that conform to the prerequisite requirements for document registration by a Data Registry (described further below), the registration package will contain an XML digital signature provided by the RG, otherwise the package will **not** contain an XML digital signature.

To ensure the authenticity of a registration 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 submitted registration package to ensure there was no alteration made to the registration package after it was produced by the RG. Verification of the digital signatures of these registration packages should be performed as prerequisite to allowing a registration package to be uploaded to the Data Registry or used for the Certificate of Compliance document registration.

The RG uses Public Key Infrastructure (PKI) to sign the registration 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 RG (see Section 5.6 for additional details).

Note: The RG 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 RG processing does not complete normally, there will be NO signature element in the registration package.

3.4 Residential Document Registration Numbering Conventions

The registration numbers assigned to 2019 residential compliance documents and to nonresidential certificates of verification by the Data Registry at the conclusion of the registration process should conform to the conventions described in this section.

3.4.1 Document Category Designators

The document category designators used in registration numbers are given in the first column of Table 3-1 below. Refer to columns 5, and 17 in Figure 3-1, and columns 5, 25, and 33 in Figure 3-2 for the location these digits appear in the registration number. The Data Registry must determine the correct document category designator for each document that is registered according to Table 3-1 and populate the applicable registration number digits for each document accordingly.

Table 3-1. Document 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	CF2R
V	PVB	Solar Photovoltaic and Battery Storage	CF2R
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

Detailed guidance for creating registration numbers is given by the following information:

- Figure 3-1 presents the organization for the numbering convention for CF1R Worksheets.
- Figure 3-2 presents the organization for the numbering convention for all other CF1R, CF2R, CF3R, and NRCV compliance documents.
- Refer to the notes for Figure 3-2 for additional detailed numbering convention guidance.
- Example registration numbers are demonstrated in Figures 3-1 and 3-2, and the interpretation of the significance of the digits used in the example registration numbers are given in Sections 3.4.2.4 and 3.4.2.5.

3.4.2.1 Model Plan and Multifamily - CF1R, CF2R, CF3R, and NRCV Configurations

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. Thus, the same building design plan and Certificate of Compliance approved by the enforcement agency may be used for each build-out of that approved model plan as long as the building design is not revised for subsequent build-outs of the model plan. The Certificate of Compliance registration number for the approved model 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 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.

3.4.2.2 CF1R Worksheet Configurations

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 should 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 (14 letter or number digits plus 2 delimiter digits). 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 well as the CF2R and CF3R documents, one unique "parent" CF1R revision level and registration number will thus be common to all compliance documents for the approved plan.

3.4.2.3 Prescriptive Additions and Alterations - CF1R, CF2R, CF3R and NRCV Configurations

When the project is a prescriptive addition to an existing building that uses a CF1R-ADD-01, or a prescriptive alteration to an existing building that uses a CF1R-ALT-01, space conditioning system(s) compliance in the building are documented using the CF1R-ALT-02. The CF1R-ALT-01 and CF1R-ADD-01 may be used for single family dwellings or for multifamily dwellings. The CF1R-ALT-02 may be used for only one dwelling unit. For alterations in a multifamily building one CF1R-ALT-02 is required for each dwelling unit in the multifamily building that contains an altered space conditioning system(s).

The relationship between the "parent" CF1R-ALT-01 and "child" CF1R-ALT-02 (or the "parent" CF1R-ADD-01 and "child"CF1R-ALT-02) is represented by using the same numbering convention layout for the CF1R-ALT-02 as is used for CF1R worksheet documents (shown in Figure 3-1), but with the further requirement that a unique dwelling unit identification number must be constrained to be the same on the "parent" CF1R (see fields 21, 22, 23 in figure 3-2), the "child" dwelling unit CF1R-ALT-02 (see fields 20, 21, 22 in Figure 3-1), and also on the CF2R and CF3R "children" of each dwelling unit CF1R-ALT-02. Refer to Note 1 (Figure 3-1) and Note 4 (Figure 3-2) below for additional explanation of this numbering convention.

Figure 3-1. Numbering Convention for CF1R Worksheets

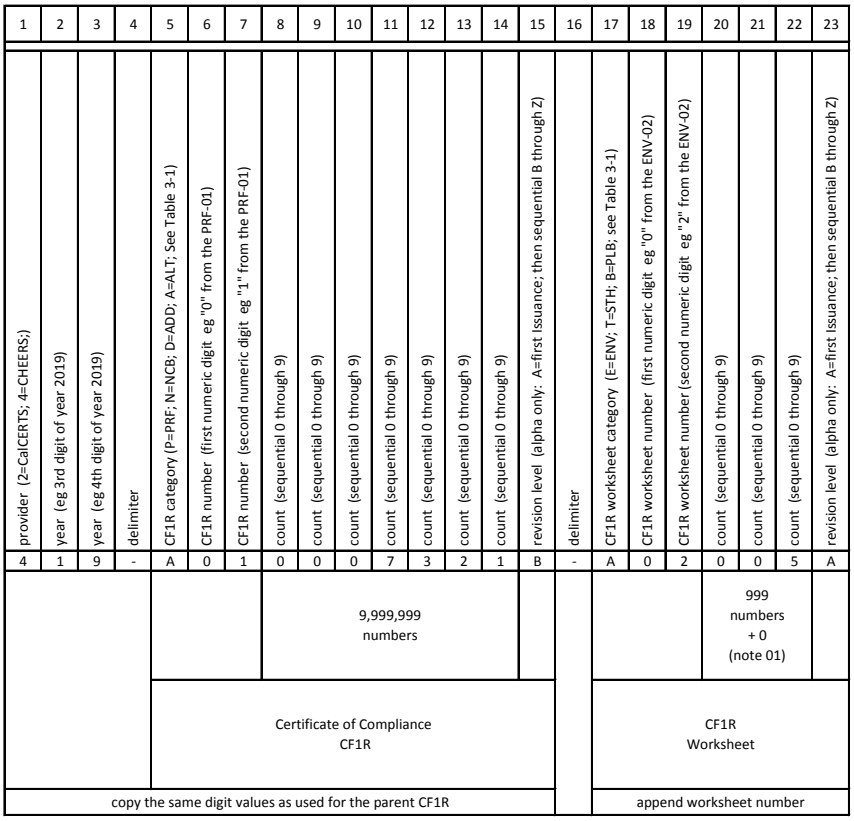


Figure 3-2. Numbering Convention for CF1R, CF2R, CF3R, and NRCV Documents

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
provider (2=CalCERTS; 4=CHEERS)	year (eg 3rd digit of year 2019)	year (eg 4th digit of year 2019)	delimiter	CF1R category (P=PRF; N=NCB; D=ADD; A=ALT; See Table 3-1)	CF1R number (first numeric digit eg "0" from the PRF-01)	CF1R number (second numeric digit eg "1" from the PRF-01)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	revision level (alpha only: A=first Issuance; then sequential B through Z)	delimiter	building count (sequential 0 through 9)	building count (sequential 0 through 9)	building count (sequential 0 through 9)	delimiter	dwelling unit count (sequential 0 through 9)	dwelling unit count (sequential 0 through 9)	dwelling unit count (sequential 0 through 9)	delimiter	CF2R category (E=ENV, L=LTG, M=MCH, B=PLB; see Table 3-1)	CF2R number (first numeric digit eg "2" from the MCH-21)	CF2R number (second numeric digit eg "1" from the MCH-21)	count (sequential 0 through 9)	count (sequential 0 through 9)	count (sequential 0 through 9)	revision level (alpha only: A=first Issuance; then sequential B through Z)	delimiter	CF3R / NRCV category (E=ENV, L=LTG, M=MCH, B=PLB; see Table 3-1)	CF3R / NRCV number (first numeric digit eg "2" from the MCH-21)	CF3R / NRCV number (second numeric digit eg "1" from the MCH-21)	revision level (alpha only: A=first Issuance; then sequential B through Z)
4	1	9	-	A	0	1	0	0	0	7	3	2	1	B	-	0	0	0	-	0	0	0	-	0	0	0	0	0	0	0	-	0	0	0	0
							9,999,999 numbers (note 2)									999 numbers + 0 (note 3)				999 numbers + 0 (note 4)							999 numbers + 0 (note 5)								
				Certificate of Compliance CF1R (note 6)												Building Count				Dwelling Unit Count				Certificate of Installation CF2R (note 7)								Certificate of Verification CF3R			
																use 000-000 for CF1R								use 0000000 for CF1R								use 0000 for CF1R and CF2R			

Notes for Figure 3-1 and Figure 3-2
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 (or ALT-02) created for a new CF1R.
- Increment sequentially by 1 for each additional worksheet (or ALT-02) created for the CF1R.
- If the parent CF1R document type is a CF1R-ADD-01 or CF1R-ALT-01, for each required CF1R-ALT-02 child document, use the numbering convention layout described in Figure 3-1 with digits 17, 18, 19 = A02, and designate (Figure 3-1) digits 20, 21, 22 as the unique identification number for the dwelling unit. For CF2R and CF3R child documents associated with a dwelling unit's CF1R-ALT-02, ensure that the parent CF1R-ADD-01 or CF1R-ALT-01 (Figure 3-2 numbering convention) dwelling unit digits 21, 22, 23 are constrained to be the same as the CF1R-ALT-02 (Figure 3-1 numbering convention) unique dwelling unit identification number digits 20, 21, 22.

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.
- If the parent CF1R document type is a CF1R-ADD-01 or CF1R-ALT-01, for each required CF1R-ALT-02 child document, use the numbering convention layout described in Figure 3-1 with digits 17, 18, 19 = A02, and designate (figure 3-1) digits 20, 21, 22 as the unique identification number for the dwelling unit. For CF2R and CF3R child documents associated with a dwelling unit's CF1R-ALT-02, ensure that the parent CF1R-ADD-01 or CF1R-ALT-01 (Figure 3-2 numbering convention) dwelling unit digits 21, 22, 23 are constrained to be the same as the CF1R-ALT-02 (Figure 3-1 numbering convention) unique dwelling unit identification number digits 20, 21, 22.
- 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.

3.4.2.4 Example Registration Numbers - CF1R, CF2R, CF3R, NRCV and CF1R Worksheet Documents

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 the notes for Figure 3-1 and Figure 3-2 above.

219-P010007321B-000-000-0000000-0000:

- Parent CF1R document
- CalCERTS Provider
- Year 2019
- Performance CF1R document (PRF-01)
- sequential number 7321,
- revision B

219-P010007321B-R01005A:

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

219-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

219-P010007321B-000-001-M21005A-M21C:

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

219-Z0000073220-002-004-0000020-M20B:

- CalCERTS Provider
- Year 2019
- 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

3.4.2.5 Example Registration Numbers - Prescriptive Alterations and Additions - CF1R-ALT-01, CF1R-ADD-01, CF1R-ALT-02

The examples given in Subsections a, b, and c below describe 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, and Figure 3-2, highlighting the various application of the numbering conventions to the CF1R-ADD-01, CF1R-ALT-01, and CF1R-ALT-02 given in Notes 1 and 4 above.

a. If a CF1R-ALT-02 is created for use as a stand-alone CF1R document, as is the case for an HVAC-only alteration project that does not require use of a CF1R-ALT-01 or a CF1R-ADD-01, then the CF1R-ALT-02 should be treated as a "base" CF1R and use the registration numbering convention shown in Figure 3-2. All CF2R/CF3R documents that are children of that base CF1R should use that base registration number as described in the following example.

419-A020007321B-000-000-0000000-0000:

- Parent CF1R document
- CHEERS Provider
- Year 2019
- Standalone HVAC Alteration CF1R document (CF1R-ALT-02)
- sequential number 7321
- revision B

419-A020007321B-000-001-M20001A-0000:

- CF2R document associated with the parent CF1R-ALT-02 above
- Single family dwelling unit
- Dwelling unit number 001 for this CF1R parent
- CF2R-MCH-20 document
- CF2R sequential number 001
- Revision A

419-A020007321B-000-001-M20001A-M20B:

- CF3R document associated with the parent CF2R document above
- CF3R-MCH-20 document
- Revision B

b. If the CF1R-ALT-02 is required as a child of a CF1R-ADD-01, then the CF1R-ALT-02 registration number must use the CF1R worksheet numbering layout shown in Figure 3-1, and any CF2R/CF3R documents that are children of the CF1R-ADD-01/CF1R-ALT-02 must use the CF1R-ADD-01 "base" numbering layout shown in Figure 3-2. A unique dwelling unit identification number must be constrained to be the same on both the CF1R-ALT-02 parent and the CF2R/CF3R children documents for each dwelling.

A single family example follows.

419-D010007322B-000-000-0000000-0000:

- Parent CF1R document
- CHEERS Provider

- Year 2019
- Prescriptive CF1R document (CF1R-ADD-01)
- sequential number 7322
- revision B

419-D010007322B-A02001A

- Child CF1R document (CF1R-ALT-02) associated with parent CF1R-ADD-01 above
- Dwelling unit identification number **001**
- Revision A

419-D010007322B-000-001-M20001A-0000

- CF2R document associated with the parent CF1R-ALT-02 above
- Single family dwelling unit
- Dwelling unit identification number **001** (constrained to be the same as parent ALT-02)
- CF2R-MCH-20 document
- CF2R sequential number 001
- Revision A

419-D020007322B-000-001-M20001A-M20B:

- CF3R document associated with the parent CF2R document above
- CF3R-MCH-20 document
- Revision B

c. If the CF1R-ALT-02 is required as a child of a CF1R-ALT-01, then the CF1R-ALT-02 registration number must use the CF1R worksheet numbering layout shown in Figure 3-1, and any CF2R/CF3R documents that are children of the CF1R-ALT-01/CF1R-ALT-02 must use the CF1R-ALT-01 "base" numbering layout shown in Figure 3-2. A designated dwelling unit identification number must be constrained to be the same on both the CF2R-ALT-02 parent and the CF2R/CF3R children documents for the dwelling.

   A multifamily example follows.

419-A010007322B-000-000-0000000-0000:

- Parent CF1R document
- CHEERS Provider
- Year 2019
- Prescriptive CF1R document (ALT-01)
- sequential number 7322

- revision B

For Dwelling Unit 001:

419-A010007322B-A02001A

- Child CF1R document (CF1R-ALT-02) associated with parent CF1R-ALT-01 above
- Dwelling unit identification number 001
- Revision A

419-A010007322B-001-001-M20001A-0000

- CF2R document associated with the parent CF1R-ALT-02 above
- Multifamily family building number 001
- Dwelling unit identification number 001 (constrained to be the same as parent ALT-02)
- CF2R-MCH-20 document
- CF2R sequential number 001
- Revision A

419-A010007322B-001-001-M20001A-M20B:

- CF3R document associated with the parent CF2R document above
- CF3R-MCH-20 document
- Revision B

For Dwelling Unit **002**:

419-A010007322B-A02**002**A
419-A010007322B-001-**002**-M20001A-0000
419-A010007322B-001-**002**-M20001A-M20B

For Dwelling Unit 003:

419-A010007322B-A02**003**A
419-A010007322B-001-**003**-M20001A-0000
419-A010007322B-001-**003**-M20001A-M20B

For a second use of the base CF1R for Multifamily Building 002:

For Multifamily Building 002 Dwelling Unit 001:

419-A010007322B-000-000-0000000-0000
419-A010007322B-A02001A
419-A010007322B-002-001-M20001A-0000

419-A010007322B-002-001-M20001A-M20B:

For Multifamily Building 002 Dwelling Unit 002:

419-A010007322B-000-000-0000000-0000
419-A010007322B-A02002A
419-A010007322B-002-002-M20001A-0000
419-A010007322B-002-002-M20001A-M20B

For Multifamily Building 002 Dwelling Unit 003:

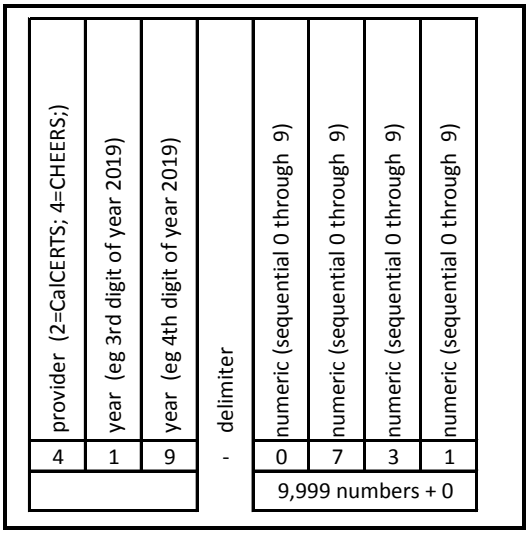
419-A010007322B-000-000-0000000-0000
419-A010007322B-A02003A
419-A010007322B-002-003-M20001A-0000
419-A010007322B-002-003-M20001A-M20B

3.5 Residential Certificate of Verification Group Numbering Conventions

HERS Provider Data Registries are required to manage the group sampling procedures. The procedures and requirements for managing sample groups are given in Reference Residential Appendix RA2 and in Reference Nonresidential Appendix NA1.

The group number is a HERS Provider Data Registry-designated identification number unique to the sample group to which a dwelling has been assigned. The group numbers assigned to residential compliance documents by the Data Registry during the Certificate of Verification registration process should use the standardized numbering convention shown in Figure 3-3 below. The group number should be reported on all Certificate of Verification documents that utilize group sampling for compliance.

Figure 3-3. Group Numbering Convention for CF3R and NRCV Documents



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 username 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 may be scanned electronically by the data registry provider and added to the user's profile. The scanned image of the wet signature may be overlaid on the completed electronic compliance document in the signature field after the user performs a signing action while logged into the data registry to generate an electronic signature for the document.

Once the user has established a username 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 or other approved representation of the user's 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 and allows the Registration Provider to make available alternative methods for creating an electronic image for displaying electronic signatures. 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 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 RG 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 RG 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 (above). 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 below.

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 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 document 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 Data Registry transmits a call to the RG that includes all required XML data to complete the document. The RG validates that data against the schema for that document and returns a PDF to the Data Registry.

b. The RG 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 RG 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 registration package received from the RG, 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 RG and then by signing, certify they are in 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 registration package received from the RG, 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 registration 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 RG 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 RG 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 2.5.1 of the 2019 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 as specified in Standards Section 10-103(a)3A, 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's 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)3A of the 2019 Energy 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 Energy 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. In order for a responsible person to delegate signature authority to another person, in accordance with Section 10-103(a)3A, a document that 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 Energy Standards Section 10-103(a)3Avi.

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 registration 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 registration 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 registration 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

The list of CA's approved by the State of California may change over time, thus if the CA used by a Data Registry for registering compliance documents is dropped from the list of CA's approved by the State of California, the Data Registry must revise their digital document signing process to utilize one of the CA's from the current list of approved CA's. If the Data Registry must change the CA used in their approval, they should notify the Energy Commission of this change.

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 registration 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 registration 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.*

- The completed registration package exported to the Energy Commission Document Repository is referred to as a *transmission* package in Section JA7.7.1.4.

A copy of the completed registration/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 digital signature by opening it with freeware such as Adobe Acrobat Reader. In order to ensure that PDF reader freeware can verify the authenticity of the registered PDF, Data Registries must provide a secure method for users to acquire the certificate issued by the Data Registry's approved CA that will add the certificate to the user's local root certificate store if necessary as described in Section 5.5.

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 digital signature by opening it with freeware such as Adobe Acrobat Reader. In order to ensure that PDF reader freeware can verify the authenticity of the registered PDF, Data Registries must provide a secure method for users to acquire the certificate issued by the Data Registry's approved CA that will add the certificate to the user's local root certificate store if necessary as described in Section 5.5.

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

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

d. The entire contents of the registration/transmission package must be digitally signed at the conclusion of the registration procedure and signed independently of the digital signing of the compliance document PDF. The digital signing of the registration/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 registration/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 in order to secure the content of this registered document, and in no way implies Registration Provider responsibility for the accuracy of the information."

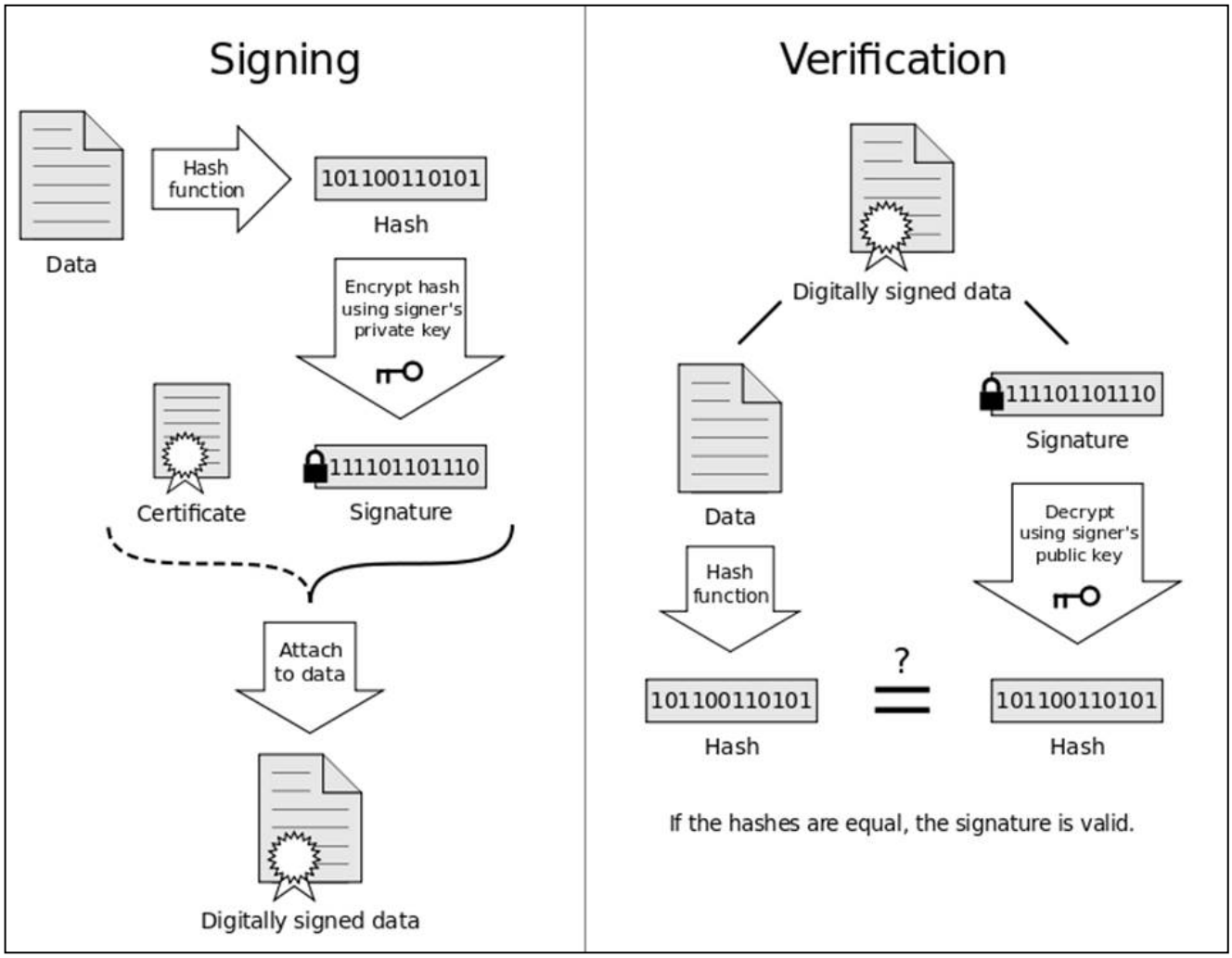
Do not include any other information such as graphic(s), watermark(s), date, or time stamps with the digital signature appearance.

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 Approved Certificate Authorities

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 format documents) using a digital certificate issued by a CA approved by the Secretary of State. The digital certificate must be issued to the Data Registry organization, and not to an individual. Digital signatures for registered compliance documents must clearly identify the Data Registry Provider as the owner of the digital signature certificate.

5.4.2 Digital Certificate Use Types

There are three different types of digital certificates that the Provider may use.

5.4.2.1 Digital Certificates for Document Signing

- Advantages
  - Certificate satisfies the requirement to validate that the document hasn't changed since signing.
  - End User doesn't have to perform additional actions to have the capability to verify authenticity of signed documents because the approved CA's certificate comes with their computer's operating system.
  - There are some automated solutions for organizations with high volume.
- Disadvantages
  - The organization is not listed as the owner in most offerings. The identity on the certificate is an employee name or a department in the organization.

- Cost for high volume solutions that require a Hardware Security Module (HSM) is expensive compared to all other solutions.
- Not offered by largest CA's.

5.4.2.2 Digital Certificates for Code Signing

- Advantages
  - Digital certificate authenticates the data registry provider as the owner and validates that the document hasn't changed since signing.
  - Times stamping avoids errors when a digital certificate expires after the document was signed, by indicating the PDF was signed while the certificate was valid.
  - Price is reasonable. This solution must be incorporated into the data registry software development which makes it automatic and not manual.
- Disadvantages
  - The CA's digital certificate for this type is not automatically provided with the computer's operating system, so the end user has to perform actions to get the CA's certificate added to their root certificates.

5.4.2.3 SSL Certificates with digital signing of documents

- Advantages
  - SSL certificate provides validation of the data registry provider and their data registry website
  - End user rarely has to do anything because the CA's root certificate is usually shipped with the end-user's operating system.
- Disadvantages
  - May not be available with SSL certificates from most approved CA's.

5.4.3 Digital Certificate Solution Options

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.

Note: the price estimates provided in this section were acquired in 2014, thus may not reflect current market pricing and are provided for information only. However, the price estimates may still provide useful relative cost comparisons for these digital certificate solution options.

5.4.3.1 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.

5.4.3.2 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 National Institute of Standards and Technology (NIST) Federal Information Processing Standard, (FIPS) Publication 140-2 Security Requirements for Cryptographic Modules. 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 Peripheral Component Interconnect (PCI) card is the hardware solution. For systems that have multiple application servers, the HSM is an external appliance.

5.4.3.3 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.

5.4.3.4 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 2018 but is subject to change, so is for information only. Refer to the most current listings on the California Secretary of State list and Adobe's Approved Trust list when determining compliance with the Data Registry requirements.

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
DigiCert	DigiCert
DocuSign, Corporation	
Entrust Datacard Limited	Entrust Datacard Limited
GeoTrust, Inc.	
GMO GlobalSign, Inc.	GMO GlobalSign, Inc
Thawte, Inc.	
Symantec Corporation	
MaxMD/Park Avenue Capital, LLC	

5.5 Root Certificates for Validation of Document Authenticity

In order to ensure that PDF reader freeware can verify the authenticity of the registered PDF documents, Data Registries must provide a method for users to acquire the certificate issued by the Data Registry's approved CA, which will add the certificate to the user's local root certificate store if necessary. The suggested method is described in Subsection 5.5.1 below.

5.5.1 Data Registry Trusted-Source PDF Method

a. Each Data Registry must provide a link on one of their SSL-secured web pages that makes available a PDF file digitally signed by the data registry that the user can open (trusted-source PDF). It should not be necessary to log in to the Data Registry in order to navigate to this secure web page.

b. The Data Registry must provide help instructions to the user to describe the method(s) needed to view the status of the digital signature in this trusted-source PDF file.

c. The Data Registry must provide help instructions to the user to describe the actions necessary to "trust" this trusted-source PDF file which should result in the Data Registry's digital certificate being added to the certificate store of the user's local personal computing device's operating system.

d. The Data Registry must provide help instructions to the user to describe the method(s) needed to review the status of the digital signature in this trusted-source PDF file to confirm the status of the digital signature which should indicate the signature is valid after adding the Registry's digital certificate to the certificate store of the user's local personal computing device's operating system.

e. If the digital signature in the trusted-source PDF file is not displayed as valid after performing the actions above, the Data Registry should provide further instructions for acquiring the certificate issued by the Data Registry's approved CA, that will add the certificate to the user's local root certificate store if necessary.

f. It may be necessary for the Data Registry to make available more than one version of a trusted-source PDF file type in order to make it possible for various types of PDF reader freeware applications to be used to validate registered compliance documents. The data Registry must provide help instruction to the user to assist in selecting the correct trusted-source file for use with their PDF reader.

5.6 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 RG for creating the Certificate of Compliance. Each version of the compliance software employs a unique Rivest–Shamir–Adleman (RSA) algorithm-based public/private key pair to sign the data prior to sending it to the RG.

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 to the PDF report output depending on the results of the verification.

5.7 RG 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.

5.8 Data Exchanges Between External Digital Data Sources (EDDS)

As an alternative to keyed-in data input for use in compliance document registration processes, the Data Registry may receive data transfers directly from external digital data sources as specified in Joint Appendix Section JA7.7.1.2, but only if the working relationship between the Data Registry and the EDDS has been approved in accordance with the requirements in Joint Appendix Section JA7.8.

Section 5.8.1, 5.8.2, 5.8.3, and 5.8.4 below summarize the requirements for use of EDDS given in Joint Appendix JA7. Refer to JA7 for additional detail.

5.8.1 EDDS Types

As specified in JA7.7.1.2.2, EDDS types may include but are not limited to:

a. Diagnostic instrument manufacturer services that incorporate wireless or web-based data-logging capabilities into their products, capture and store relevant information from field diagnostic testing procedures, and provide digital access to the stored data to the diagnostic tool owners and other parties to the field verification procedure.

b. Third party quality control programs (TPQCP) that verify the work of participating installers, collect and evaluate more detailed data than necessary for compliance, identify in real-time during the installation invalid and inaccurate installer testing and noncompliant installations, and enable corrected testing with the goal of bringing installations into compliance before the installer leaves the job site. TPQCP descriptions and requirements are specified in Appendix RA2.7.

c. Internet-based datastores that are administered by an EDDS services provider, to ensure the security and integrity of data input to the datastore by authorized users of Title 24, Part 6 Data Registries, who subsequently transmit the stored data to a Title 24, Part 6 Data Registry while logged-in to the Data Registry during Title 24, Part 6 document registration procedures.

5.8.2 EDDS Requirements

As specified in JA7.7.1.2, Digital Data Sources External to a Data Registry, the data uploads to an EDDS, and the data exchange between a Data Registry and an EDDS shall conform to the following:

a. The data exchange from an EDDS to a Data Registry shall be initiated only by an authorized user of the Data Registry; only while the user is logged into his Title 24, Part 6 Data Registry user account; and only by use of a data exchange feature managed and made available to the user by the Data Registry user interface.

b. The data exchange from an EDDS to a Data Registry shall not be an unattended automatic electronic data exchange transaction.

c. The Registration Provider shall ensure the authorized user has the opportunity to review and revise the information transmitted to the data registry by use of an EDDS prior to making electronic signature controls available to the user.

d. The Registration Provider shall be responsible for managing the security and integrity of the data exchange with the EDDS.

e. The Registration Provider shall ensure that user data uploads to the EDDS, and subsequent storage and maintenance of compliance data in the EDDS are done using best practices for secure data exchange and secure data storage.

f. The Registration Provider shall ensure that the data exchange processes that import data into the Data Registry from the EDDS are performed using best practices for secure data exchange.

g. The user's compliance data may be uploaded automatically to an EDDS datastore, such as by network-connected diagnostic field verification instruments, or it may be keyed in by the user using an EDDS services software user interface.

h. The data transmitted from an EDDS to a Data Registry shall conform to the XML schema for each respective Title 24, Part 6 compliance document for which the data is to be used. All data provided to complete compliance documents shall be subjected to data validation by the Data Registry software after the data is transmitted to the Data Registry.

i. The current compliance document schemas approved by the Energy Commission shall be made available to the EDDS services providers as needed in order to clarify the Title 24 Part 6 compliance document data requirements.

5.8.3 EDDS Approval

Joint Appendix Section JA7.8 requires that when an application for a Data Registry approval includes use of EDDS, the Energy Commission shall perform acceptance testing of the EDDS proposed to be used for data input by authorized users of the Data Registry.

JA7.8.2.6 requires applications for approval of Data Registry use of EDDS services to include documentation to disclose the details of the working agreement(s) or contract(s) between the Registration Provider and EDDS services entity. This documentation must include descriptions of the parties involved, and the technologies used for the data exchanges between the EDDS and the Data Registry.

The contract executed between a Registration Provider and an External Digital Data Source (EDDS) services provider is prerequisite to approval of the EDDS for use for transmittal of data to the Data Registry for Title 24, Part 6 document registration. The agreement is required to describe the specifications of any Internet-based EDDS services or EDDS software utilized to store the compliance document data on behalf of authorized users of the Data Registry, including description of any Internet-based data gateway interfaces used for sharing the compliance data with third parties.

A separate agreement is required for each working relationship between a Data Registry and an EDDS. EDDS services providers may be approved to provide services to any number of approved Registration Providers. Registration Providers may be approved for use of any number of EDDS services providers.

5.8.4 EDDS User Instructions

JA7.8.5.6 requires that when a Data Registry is approved to make available use of EDDS features to authorized users of the Data Registry for data input during document registration procedures, the Data Registry user manual shall include instructions for use of those features. The instructions shall describe use of the Data Registry user interface for EDDS data input procedures. Additionally, if the EDDS services provider has a user interface or software application that the user is expected to access and operate that is independent of the Data Registry user interface, a copy of the EDDS service or software user instructions shall be included in the Data Registry User Manual.

6 Document Configuration Rules

6.1 Overview

High level document configuration requirements are specified in *2019 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 *2019 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 2019 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 Energy Standards Section 150.0(m)13:

a. The mandatory requirements in Section 150.0(m)13 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)13 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 Energy Standards.

Data Registry staff should not be required to determine whether the overridden/new data value complies with the Energy 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 Energy 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 2019 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 if newly constructed building, or prescriptive newly constructed addition greater than 1,000 ft^2, then require one CF1R-NCB-01 for the building.

Document Number	Document Type	Document Description	Document Configuration Rules
			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 or Equal To 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 (including ADUs), then require one CF1R-ADD-01 for the building. The CF1R-ADD-01 is applicable to single family and multifamily buildings.
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

Document Number	Document Type	Document Description	Document Configuration Rules
			prescriptive and project scope is alteration to one or more building components, including an alteration to a space conditioning systems, then require on 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.
CF1R-ALT-02-E	Prescriptive Certificate of Compliance	Space Conditioning System(s) Alterations (Prescriptive)	Prompt user to select compliance method and project scope. If compliance

Document Number	Document Type	Document Description	Document Configuration Rules
			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. Else if 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 CF1R-ALT-02 for the single family dwelling unit identified on the CF1R that requires installation or alteration of a space conditioning

Document Number	Document Type	Document Description	Document Configuration Rules
			system. Else if 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 CF1R-ALT-02 for each dwelling unit in the multifamily building identified on the CF1R that requires installation or alteration of a space conditioning system.
CF1R-ENV-02-E	Prescriptive Certificate of Compliance	Area Weighted Average Calculation Worksheet	Prompt user to declare whether they need to use an area weighted average to meet any of the prescriptive U-values or SHGC values. User elects to register a CF1R-ENV-02 when an area weighted

Document Number	Document Type	Document Description	Document Configuration Rules
			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. Require one CF1R-ENV-02 for each feature being area-weighted. When a CF1R-ENV-02 is required for compliance, registration of the CF1R-ENV-02 is a prerequisite to allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01). This worksheet is used to calculate the area-weighted average U-factors for building envelope features

Document Number	Document Type	Document Description	Document Configuration Rules
			such as opaque exterior doors, walls, roofs, ceilings, floors, mass, and fenestration/glazing U-factors or Solar Heat gain Coefficients (SHGC) values for prescriptive compliance.
CF1R-ENV-03-E	Prescriptive Certificate of Compliance	Solar Heat Gain Coefficient (SHGC) Worksheet (Prescriptive)	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01, CF1R-ALT-01, or CF1R-ADD-01, and the value for Exterior Shading Device does not equal "None", then require one CF1R-ENV-03 for the project. When a CF1R-ENV-03 is required for compliance, registration of the CF1R-ENV-03 document is a prerequisite to

Document Number	Document Type	Document Description	Document Configuration Rules
			allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01).
CF1R-ENV-04-E	Prescriptive Certificate of Compliance	Cool Roof and Solar Reflectance Index (SRI) Worksheet (Prescriptive)	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01, CF1R-ALT-01, or CF1R-ADD-01, require one CF1R-ENV-04 for each roofing feature listed on the C1R that lists a value for Proposed SRI. When a CF1R-ENV-04 is required for compliance, registration of all applicable CF1R-ENV-04 documents is a prerequisite to allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01).
CF1R-ENV-05-E	Certificate of Compliance	Alternative Default Fenestration Procedure (NA6)	If the CF1R for the project is one of the following types:

Document Number	Document Type	Document Description	Document Configuration Rules
		Worksheet	CF1R-PRF-01, CF1R-NCB-01, CF1R-ALT-01, or CF1R-ADD-01, and the value for Fenestration U-factor and/or SHGC Source is 'ADFP' or 'NA6 Equations', then require one CF1R-ENV-05 for the project. When a CF1R-ENV-05 is required for compliance, registration of the CF1R-ENV-05 document is a prerequisite to allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01, PRF-01).
CF1R-ENV-06-E	Prescriptive Certificate of Compliance	Interior and Exterior Insulation Layers Worksheet (Prescriptive)	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01, CF1R-ALT-01, or CF1R-ADD-01, require one CF1R-ENV-06 for each

Document Number	Document Type	Document Description	Document Configuration Rules
			mass wall listed on the CF1R that has a value for Interior and/or Exterior Insulation. When a CF1R-ENV-06 is required for compliance, registration of the CF1R-ENV-06 document is a prerequisite to allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01).
CF1R-PLB-01-E	Prescriptive Certificate of Compliance	Hydronic Heating System(s) Worksheet (Prescriptive)	If the CF1R for the project is one of the following prescriptive CF1R types: CF1R-NCB-01, CF1R-ALT-01, CF1R-ADD-01, or CF1R-ALT-02, and the space conditioning heating system type identified on the CF1R is one of the following types: Hydronic, Combined

Document Number	Document Type	Document Description	Document Configuration Rules
			Hydronic, Hydronic + Forced Air, or Combined Hydronic + forced Air, then require one CF1R-PLB-01 for each of the hydronic heating systems listed on the CF1R. When a CF1R-PLB-01 is required for compliance, registration of all applicable CF1R-PLB-01 documents is a prerequisite to allowing registration of the parent CF1R (ALT-01, ADD-01, NCB-01, ALT-02).
CF1R-STH-01-E	Certificate of Compliance	OG 100 (California F-Chart) Solar Water Heating System(s) Worksheet	When the CF1R-NCB-01 indicates requirement for Solar Heated Domestic Hot Water Heating query the user to provide the rating methodology from Solar Rating and Certification

Document Number	Document Type	Document Description	Document Configuration Rules
			Corporation (SRCC) either OG300 or OG100. If the user selects OG100 compliance shall require use of on CF1R-STH-01 for each solar water heating system installed. When a CF1R-STH-01 is required for compliance, registration of all applicable CF1R-STH-01 documents is a prerequisite to allowing registration of the CF2R and CF3R documents.
CF2R-ENV-01-E	Certificate of Installation	Fenestration Installation	If the CF1R specifies fenestration features, require one CF2R-ENV-01 for each CF1R. Else if the CF1R does not specify fenestration features, a CF2R-ENV-01 is not

Document Number	Document Type	Document Description	Document Configuration Rules
			required.
CF2R-ENV-03-E	Certificate of Installation	Insulation Installation	If the CF1R specifies insulation features, require one CF2R-ENV-03 for each CF1R. Else if the CF1R does not specify insulation features, a CF2R-ENV-03 is not required.
CF2R-ENV-04-E	Certificate of Installation	Roofing; Ventilation; Cool Roofs	If the CF1R specifies Radiant Barrier or Cool Roof features, require one CF2R-ENV-04 for each CF1R. Else if the CF1R does not specify Radiant Barrier or Cool Roof features, a CF2R-ENV-04 is not required.
CF2R/CF3R-ENV-20a-H	Certificate of Installation/Verification	Enclosure Air Leakage Diagnostic Test – Single Point Air Tightness Test with Manual Meter	When the CF1R indicates requirement for Envelope Leakage HERS verification for the dwelling, require one ENV-20 per building.
CF2R/CF3R-ENV-20b-H	Certificate of Installation/Verification	Enclosure Air Leakage Diagnostic	When the CF1R indicates

Document Number	Document Type	Document Description	Document Configuration Rules
		Test – Single Point Air Tightness Test with Automatic Meter	requirement for Envelope Leakage HERS verification for the dwelling, require one ENV-20 per building.
CF2R/CF3R-ENV-21-H	Certificate of Installation/Verification	Quality Insulation Installation (QII) – Air Infiltration Sealing (Framing Stage)	When the CF1R indicates requirement for QII HERS verification for the dwelling, compliance shall be demonstrated using all the QII HERS verification compliance documents (ENV-21 & ENV-22). Require one ENV-21 per building.
CF2R/CF3R-ENV-22-H	Certificate of Installation/Verification	Quality Insulation Installation (QII) – Insulation Installation	If the CF1R-PRF-01 indicates compliance credit for Nondefault SPF R-value, then require one ENV-22 per building. Else, if ENV-21 is required, then require one ENV-22 per building.
CF3R-EXC-20-H	Certificate of Verification	HERS Verification for Existing Conditions for	When credit for existing conditions is used on the

Document Number	Document Type	Document Description	Document Configuration Rules
		Performance Compliance for Alterations	CF1R, as a condition for CF1R registration, an EXC-20 that verifies the existing condition claimed on the CF1R shall first be registered. Required as a prerequisite to registration of a CF1R-PRF for an altered dwelling.
CF2R-LTG-01-E	Certificate of Installation	Lighting – Single Family Dwellings	If the building type on the CF1R is single family and the scope of the project is a 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. If the scope includes lighting, then require one CF2R-LTG-01 per dwelling unit.

Document Number	Document Type	Document Description	Document Configuration Rules
			Else CF2R-LTG-01 is not required.
CF2R-LTG-02-E	Certificate of Installation	Lighting – Multifamily Dwellings	If the building type on the CF1R is multifamily and the scope of the project is a Newly Constructed Building, then require one CF2R-LTG-02 for each dwelling unit. Else prompt user to declare whether the scope of the project includes lighting. If the scope includes lighting, then require one CF2R-LTG-02 for each dwelling unit. Else CF2R-LTG-02 is not required.
CF2R-MCH-01a-E	Certificate of Installation	Space Conditioning Systems, Ducts and Fans – for Performance Compliance for Newly Constructed Buildings	If the CF1R type is a CF1R-PRF-01 and the project scope is Newly Constructed Building, then require one CF2R-MCH-01a for each dwelling unit for

Document Number	Document Type	Document Description	Document Configuration Rules
			which there are HVAC system compliance requirements given on the CF1R.
CF2R-MCH-01b-E	Certificate of Installation	Space Conditioning Systems, Ducts and Fans – for Prescriptive Alterations	If the CF1R type is a CF1R-ALT-02, then require one CF2R-MCH-01b for each dwelling unit for which there are HVAC system compliance requirements given on the CF1R-ALT-02. Note: Refer also to the rules for configuration of the CF1R-ALT-02 above.
CF2R-MCH-01c-E	Certificate of Installation	Space Conditioning Systems, Ducts and Fans – for Prescriptive Newly Constructed Buildings	If the CF1R type is a CF1R-NCB-01, then require one CF2R-MCH-01c for each dwelling unit for which there are HVAC system compliance requirements given on the CF1R.
CF2R-MCH-01d-E	Certificate of Installation	Space Conditioning Systems, Ducts and Fans – for	If the CF1R type is a CF1R-PRF-01 and the project scope is

Document Number	Document Type	Document Description	Document Configuration Rules
		Performance Compliance for Additions and Alterations, or Addition Alone	one of the following two types: (1) Addition and/or alteration; or (2) Newly Constructed – Addition Alone, then require one CF2R-MCH-01d for each dwelling unit for which there are HVAC compliance requirements given on the CF1R.
CF2R-MCH-02-E	Certificate of Installation	Whole House Fan	For single family projects in climate zones 8-14; if certificate of compliance type is prescriptive new construction (NCB), then require one CF2R-MCH-02 for the dwelling. Else, if the certificate of compliance type is prescriptive addition or alteration, then prompt user to declare whether a MCH-02 is needed.

Document Number	Document Type	Document Description	Document Configuration Rules
			If the certificate of compliance type is performance (PRF), then if ventilation cooling system type from the CF1R is whole house fan and the field verification status is no, 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.
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-

Document Number	Document Type	Document Description	Document Configuration Rules
			01 is one of the following types: *evaporative – direct, *evaporative – indirect *evaporative – indirect-direct
CF2R/CF3R-MCH-20a-H	Certificate of Installation/Verification	Duct Leakage Measurement – Completely New Duct System	If the MCH-01 specifies a MCH-20 is required for a ducted indoor unit, then provide one MCH-20 for the ducted indoor unit. Each ducted indoor unit that requires verification must have its own MCH-20.
CF2R/CF3R-MCH-20b-H	Certificate of Installation/Verification	Duct Leakage Measurement – Low Leakage Ducts in Conditioned Space	If the MCH-01 specifies a MCH-20 is required for a ducted indoor unit, then provide one MCH-20 for the ducted indoor unit. Each ducted indoor unit that requires verification must have its own MCH-20.
CF2R/CF3R-MCH-	Certificate of	Duct Leakage	If the MCH-01

Document Number	Document Type	Document Description	Document Configuration Rules
20c-H	Installation/Verification	Measurement – Low Leakage Air Handling Unit	specifies a MCH-20 is required for a ducted indoor unit, then provide one MCH-20 for the ducted indoor unit. Each ducted indoor unit that requires verification must have its own MCH-20.
CF2R/CF3R-MCH-20d-H	Certificate of Installation/Verification	Duct Leakage Measurement – Complete Replacement or Altered Duct System	If the MCH-01 specifies a MCH-20 is required for a ducted indoor unit, then provide one MCH-20 for the ducted indoor unit. Each ducted indoor unit that requires verification must have its own MCH-20.
CF2R/CF3R-MCH-20e-H	Certificate of Installation/Verification	Duct Leakage Measurement – Sealing of All Accessible Leaks Using Smoke Test	If the MCH-01 specifies a MCH-20 is required for a ducted indoor unit, then provide one MCH-20 for the ducted indoor unit. Each ducted indoor unit that requires

Document Number	Document Type	Document Description	Document Configuration Rules
			verification must have its own MCH-20.
CF2R/CF3R-MCH-21-H	Certificate of Installation/Verification	Duct Location Verification	If the MCH-01 specifies a MCH-21 is required for a ducted indoor unit, then provide one CF2R-MCH-21 for the ducted indoor unit. Each ducted indoor unit that requires verification must have its own MCH-21.
CF2R/CF3R-MCH-22a-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) – Newly Installed Non-Zoned Systems or Zoned Multi-Speed Compressor Systems	If the MCH-01 specifies a MCH-22 is required for a ducted indoor unit, then provide one MCH-22 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-22.
CF2R/CF3R-MCH-22b-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) – Newly Installed Zoned Single	If the MCH-01 specifies a MCH-22 is required for a ducted indoor unit, then provide one

Document Number	Document Type	Document Description	Document Configuration Rules
		Speed Compressor System	MCH-22 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-22.
CF2R/CF3R-MCH-22c-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) – newly Installed Non-Zoned or Zoned Multi-Speed Compressor Systems with Central Fan Ventilation Cooling	If the MCH-01 specifies a MCH-22 is required for a ducted indoor unit, then provide one MCH-22 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-22.
CF2R/CF3R-MCH-22d-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) – Newly Installed Zoned Single Speed Compressor Systems with Central Fan Ventilation Cooling	If the MCH-01 specifies a MCH-22 is required for a ducted indoor unit, then provide one MCH-22 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-22.
CF2R/CF3R-MCH-	Certificate of	Forced Air System	If the MCH-01

Document Number	Document Type	Document Description	Document Configuration Rules
23a-H	Installation/Verification	Airflow Rate (cfm/ton) – Newly Installed non-Zoned Systems or Zoned Multi-Speed Compressor Systems	specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-23.
CF2R/CF3R-MCH-23b-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) – Newly Installed Zoned Single Speed Compressor Systems	If the MCH-01 specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-23.
CF2R/CF3R-MCH-23c-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) – Alternative to Compliance with Minimum System Airflow Requirement for Altered Systems (Best That I Can	If the MCH-01 specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each ducted indoor unit. Note: Each ducted indoor unit that

Document Number	**Document Type**	**Document Description**	**Document Configuration Rules**
		Do)	requires verification must have its own MCH-23.
CF2R/CF3R-MCH-23d-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) – Newly Installed Heating Only Non-Zoned Systems (Measurement Only)	If the MCH-01 specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-23.
CF2R/CF3R-MCH-23e-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) – Newly Installed Non-Zoned Systems or Zoned Multi-Speed Compressor with Central Fan Ventilation Cooling	If the MCH-01 specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-23.
CF2R/CF3R-MCH-23f-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) – Newly Installed Zoned Single Speed Compressor	If the MCH-01 specifies a MCH-23 is required for a ducted indoor unit, then provide one MCH-23 for each

Document Number	Document Type	Document Description	Document Configuration Rules
		Systems with Central Fan Ventilation Cooling	ducted indoor unit. Note: Each ducted indoor unit that requires verification must have its own MCH-23.
CF2R/CF3R-MCH-24a-H	Certificate of Installation/Verification	Enclosure Air Leakage Worksheet – Single Point Air Tightness Test with Manual Meter	If the building type is multifamily, and the IAQ ventilation system type for the dwelling units in the building as specified on the CF1R-PRF-01 or CF1R-NCB-01 are one of the following types: *Supply, *Exhaust, *Central Ventilation System – Supply, or *Central Ventilation System – Exhaust, then require one MCH-24 for each such dwelling unit in the building. Else, MCH-24 doc only used if called for by MCH-27 docs.
CF2R/CF3R-MCH-	Certificate of	Enclosure Air	If the building type

Document Number	Document Type	Document Description	Document Configuration Rules
24b-H	Installation/Verification	Leakage Worksheet – Single Point Air Tightness Test with Automatic Meter	is multifamily, and the IAQ ventilation system type for the dwelling units in the building as specified on the CF1R-PRF-01 or CF1R-NCB-01 are one of the following types: *Supply, *Exhaust, *Central Ventilation System – Supply, or *Central Ventilation System – Exhaust, then require one MCH-24 for each such dwelling unit in the building. Else, MCH-24 doc only used if called for by MCH-27 docs.
CF2R/CF3R-MCH-25a-H	Certificate of Installation/Verification	Refrigerant Charge Verification – Superheat Method (Standard Charge Procedure)	If the MCH-01 specifies a MCH-25 is required, then provide one MCH-25 for each space conditioning system.
CF2R/CF3R-MCH-25b-H	Certificate of Installation/Verification	Refrigerant Charge Verification – Sub-	If the MCH-01 specifies a MCH-25

Document Number	Document Type	Document Description	Document Configuration Rules
		cooling Method (Standard Charge Procedure)	is required, then provide one MCH-25 for each space conditioning system.
CF2R/CF3R-MCH-25c-H	Certificate of Installation/Verification	Refrigerant Charge Verification – Weigh-in Charging Procedure	If the MCH-01 specifies a MCH-25 is required, then provide one MCH-25 for each space conditioning system.
CF2R/CF3R-MCH-25d-H	Certificate of Installation/Verification	Refrigerant Charge Verification – Fault Indicator Display (FID) (embedded in the CF2R-MCH-25a,b,c,e and standalone CF3R-MCH-25d)	If the MCH-01 specifies a MCH-25 is required, then provide one MCH-25 for each space conditioning system.
CF2R/CF3R-MCH-25e-H	Certificate of Installation/Verification	Refrigerant Charge Verification – Winter Setup	If the MCH-01 specifies a MCH-25 is required, then provide one MCH-25 for each space conditioning system.
CF2R-MCH-25f-E	Certificate of Installation	Refrigerant Charge Verification – Packaged System Manufacturer Refrigerant Charge Certification (CF2R only for the 'f' variant)	If the MCH-01 specifies a MCH-25 is required, then provide one MCH-25 for each space conditioning system.

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R/CF3R-MCH-26-H	Certificate of Installation/Verification	Rated Space Conditioning System Equipment Verification	When MCH-26 is required by the MCH-01, provide one MCH-26 for each space conditioning system according to the MCH-01.
CF2R/CF3R-MCH-27a-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation – Single Family Attached/Detached Ventilation	If the CF1R type is a CF1R-NCB-01, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-ADD-01, and the project scope is one of the following: *ADU Addition ≤ 300 ft^2, *ADU Addition > 300 to ≤ 400 ft^2, *ADU Addition > 400 to ≤ 700 ft^2, or *ADU Addition > 700 to ≤ 1,000 ft^2, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-PRF-01 and indicates requirement for

Document Number	Document Type	Document Description	Document Configuration Rules
			IAQ HERS Verification, then require one MCH-27 for each dwelling unit. Else, the MCH-27 is not required for the dwelling. Note: Non-dwelling units are exempt from the indoor air quality ventilation requirements and shall use the MCH-27d to document.
CF2R/CF3R-MCH-27b-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation – Multifamily Ventilation	If the CF1R type is a CF1R-NCB-01, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-ADD-01, and the project scope is one of the following: *ADU Addition ≤ 300 ft^2, *ADU Addition > 300 to ≤ 400 ft^2, *ADU Addition > 400 to ≤ 700 ft^2, or *ADU Addition >

Document Number	Document Type	Document Description	Document Configuration Rules
			700 to ≤ 1,000 ft^2, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-PRF-01 and indicates requirement for IAQ HERS Verification, then require one MCH-27 for each dwelling unit. Else, the MCH-27 is not required for the dwelling. Note: Non-dwelling units are exempt from the indoor air quality ventilation requirements and shall use the MCH-27d to document.
CF2R/CF3R-MCH-27c-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation – Single Family and Multifamily – Scheduled and Real-Time Control	If the CF1R type is a CF1R-NCB-01, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-ADD-01, and the project

Document Number	Document Type	Document Description	Document Configuration Rules
			scope is one of the following: *ADU Addition ≤ 300 ft^2, *ADU Addition > 300 to ≤ 400 ft^2, *ADU Addition > 400 to ≤ 700 ft^2, or *ADU Addition > 700 to ≤ 1,000 ft^2, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-PRF-01 and indicates requirement for IAQ HERS Verification, then require one MCH-27 for each dwelling unit. Else, the MCH-27 is not required for the dwelling. Note: Non-dwelling units are exempt from the indoor air quality ventilation requirements and shall use the MCH-27d to document.

Document Number	Document Type	Document Description	Document Configuration Rules
CF2R-MCH-27d-E	Certificate of Installation	IAQ and Mechanical Ventilation – Non-Dwelling Unit	If the CF1R type is a CF1R-NCB-01, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-ADD-01, and the project scope is one of the following: *ADU Addition ≤ 300 ft^2, *ADU Addition > 300 to ≤ 400 ft^2, *ADU Addition > 400 to ≤ 700 ft^2, or *ADU Addition > 700 to ≤ 1,000 ft^2, then require one MCH-27 for each dwelling unit. If the CF1R type is a CF1R-PRF-01 and indicates requirement for IAQ HERS Verification, then require one MCH-27 for each dwelling unit. Else, the MCH-27 is not required for the

Document Number	Document Type	Document Description	Document Configuration Rules
			dwelling. Note: Non-dwelling units are exempt from the indoor air quality ventilation requirements and shall use the MCH-27d to document.
CF2R/CF3R-MCH-28-H	Certificate of Installation/Verification	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.
CF2R/CF3R-MCH-29-H	Certificate of Installation/Verification	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.
CF2R/CF3R-MCH-30-H	Certificate of Installation/Verification	Central Fan Ventilation Cooling Systems (CFVCS)	When the CF1R-PRF-01 indicates Central Fan Ventilation Cooling System (VCS) was used, require one MCH-30 for each Central Fan VCS installed in the dwelling.
CF2R/CF3R-MCH-31a-H	Certificate of Installation/Verification	Whole House Fan Airflow and Fan	When the CF1R-PRF-01 indicates

Document Number	Document Type	Document Description	Document Configuration Rules
		Efficacy – Individual CFM and Watts Collection	compliance credit for HERS Cool Vent Verification, then require one MCH-31 for each dwelling unit.
CF2R/CF3R-MCH-31b-H	Certificate of Installation/Verification	Whole House Fan Airflow and Fan Efficacy – Individual CFM and Total Watts Collection	When the CF1R-PRF-01 indicates compliance credit for HERS Cool Vent Verification, then require one MCH-31 for each dwelling unit.
CF2R/CF3R-MCH-31c-H	Certificate of Installation/Verification	Whole House Fan Airflow and Fan Efficacy – Total CFM and Individual Watts Collection	When the CF1R-PRF-01 indicates compliance credit for HERS Cool Vent Verification, then require one MCH-31 for each dwelling unit.
CF2R/CF3R-MCH-31d-H	Certificate of Installation/Verification	Whole House Fan Airflow and Fan Efficacy – Total CFM and Watts Collection	When the CF1R-PRF-01 indicates compliance credit for HERS Cool Vent Verification, then require one MCH-31 for each dwelling unit.
CF2R/CF3R-MCH-32-H	Certificate of Installation/Verification	Local Mechanical Exhaust – Kitchen Range Hood	When the CF1R indicates requirement for Kitchen Ventilation HERS verification

Document Number	Document Type	Document Description	Document Configuration Rules
			for the dwelling, require one MCH-32 per kitchen. Note: CBECC currently does not have the ability to model kitchens therefore HERS registry should query the user as to how many kitchens are contained within the dwelling. Value must be greater than or equal to 1.
CF2R/CF3R-MCH-33-H	Certificate of Installation/Verification	VCHP Compliance Credit	When the MCH-33 is required by the MCH-01, provide one MCH-33 for each VCHP system installed.
CF2R-MCH-34-E	Certificate of Installation	Pre-Cooling Compliance Credit	When the CF1R-PRF indicates compliance credit for Pre-Cooling, require one MCH-34 per dwelling unit.
CF2R-PLB-01a-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

Document Number	Document Type	Document Description	Document Configuration Rules
			type on the CF1R is not N/A, then require one CF2R-PLB-01a for the building. Else, if the value for central DHW system distribution type on the CF1R is N/A, then the CF2R-PLB-01a is not required. Note: The CF2R-PLB-01 is not applicable to single family dwelling units.
CF2R-PLB-01b-E	Certificate of Installation	Multifamily Central Hot Water System Distribution (Non-HERS) – NEEA Certified Heat Pump Water Heater	If the building type is multifamily, and the value for central DHW system distribution type on the CF1R is not N/A and the installed water heater is a heat pump water heater, then require one CF2R-PLB-01b for the building. Else, if the value for central DHW

Document Number	Document Type	Document Description	Document Configuration Rules
			system distribution type on the CF1R is N/A, then the CF2R-PLB-01b is not required. Note: The CF2R-PLB-01 is not applicable to single family dwelling units.
CF2R-PLB-02a-E	Certificate of Installation	Single Dwelling Unit Hot Water Distribution (Non-HERS)	If the building type is multifamily, require one CF2R-PLB-02a for each dwelling unit that has a dedicated water heating system with a non-HERS-verified distribution type. If the building type is single family, require one CF2R-PLB-02a for the dwelling unit if the dwelling unit contains a water heating system with a non-HERS-verified distribution type. Else, if the dwelling

Document Number	Document Type	Document Description	Document Configuration Rules
			unit does not have a water heating system, then a CF2R-PLB-02a is not required.
CF2R-PLB-02b-E	Certificate of Installation	Single Dwelling Unit Hot Water Distribution (Non-HERS) – NEEA Certified Heat Pump Water Heater	If the building type is multifamily, require one CF2R-PLB-02b for each dwelling unit that has a dedicated water heating system with a non-HERS-verified distribution type, and the installed heat pump water heater is identified as a NEEA certified model. If the building type is single family, require one CF2R-PLB-02b for the dwelling unit if the dwelling unit contains a water heating system with a non-HERS-verified distribution type, and the installed heat pump water heater is identified as a

Document Number	Document Type	Document Description	Document Configuration Rules
			NEEA certified model. Else, if the dwelling unit does not have a water heating system, then a CF2R-PLB-02b is not required.
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 a replacement pool or spa component. If the response is yes, then require one CF2R-PLB-03. Else, if the response is no, then the CF2R-PLB-03 is not required.
CF2R/CF3R-PLB-21a-H	Certificate of Installation/Verification	Multifamily Central Hot Water System Distribution (HERS)	If the CF1R-PRF indicates the building type is multifamily, the value on the CF1R is not N/A and the value is a HERS-verified distribution

Document Number	Document Type	Document Description	Document Configuration Rules
			type, then require one PLB-21a for the building. Else, if the value for central DHW system distribution type on the CF1R is N/A, then the PLB-21a is not required. Note: The PLB-21a is not applicable to single family dwelling units.
CF2R/CF3R-PLB-21b-H	Certificate of Installation/Verification	Multifamily Central Hot Water System Distribution (HERS) – NEEA Certified Heat Pump Water Heater	If the CF1R-PRF indicates the building type is multifamily, the value for central DHW system distribution type on the CF1R is not N/A and the value is a HERS-verified distribution type, and the installed heat pump water heater is identified as a NEEA certified model, then require one PLB-21b for the building. Else, if the value

Document Number	Document Type	Document Description	Document Configuration Rules
			for central DHW system distribution type on the CF1R is N/A, then the PLB-21b is not required. Note: The PLb-21b is not applicable to single family dwelling units.
CF2R/CF3R-PLB-22a-H	Certificate of Installation/Verification	Single Dwelling Unit Hot Water System Distribution (HERS)	If the building type is multifamily, require one PLB-22a for each dwelling unit that has a water heating system with a HERS-verified distribution type, drain water heat recovery, or expanded-credit compact design. If the building type is single family, require one PLB-22a for the dwelling unit if the dwelling unit contains a water heating system with a HERS-verified distribution type, drain water

Document Number	Document Type	Document Description	Document Configuration Rules
			heat recovery, or expanded-credit compact design. Else, if the dwelling does not have a water heating system, then a PLB-22a is not required.
CF2R/CF3R-PLB-22b-H	Certificate of Installation/Verification	Single Dwelling Unit Hot Water System Distribution (HERS) – NEEA Certified Heat Pump Water Heater	If the building type is multifamily, require one PLB-22b for each dwelling unit that has a water heating system with a HERS-verified distribution type, drain water heat recovery, or expanded-credit compact design, and the installed heat pump water heater is identified as a NEEA certified model. If the building type is single family, require one PLB-22b for the dwelling unit if the dwelling unit

Document Number	Document Type	Document Description	Document Configuration Rules
			contains a water heating system with a HERS-verified distribution type, drain water heat recovery, or expanded-credit compact design, and the installed heat pump water heater is identified as a NEEA certified model. Else, if the dwelling does not have a water heating system, a PLB-22b is not required.
CF2R-PVB-01-E	Certificate of Installation	Photovoltaic (PV) Systems	If the CF1R project scope is Newly Constructed Building, require one PVB-01 per building.
CF2R-PVB-02-E	Certificate of Installation	Battery Storage Systems	If the CF1R-PRF-01 indicates compliance credit for "Battery Storage System", or CF2R-PVB-01 indicates exception "Batter Storage", require one PVB-02 per building.
CF2R-SRA-01-E	Certificate of	Solar Ready	When the CF2R-

Document Number	Document Type	Document Description	Document Configuration Rules
	Installation	Buildings	PVB-01 indicates exception "No PV – limited solar access", require one SRA-01 per building.
CF2R-SRA-02-E	Certificate of Installation	Minimum Solar Zone Area Worksheet	When CF2R-SRA-02 is required by CF2R-SRA-01, require one CF2R-SRA-02 per building.
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 – Completely New Duct System	One NRCV-MCH-04 shall be required for each duct system identified as requiring duct leakage testing on the Certificate of Compliance. Alternatively, an approved Acceptance Test Technician Certification
NRCV-MCH-04c-H	Certificate of Verification	Nonresidential Duct Leakage Measurement – Low Leakage Air Handling Unit	
NRCV-MCH-04d-H	Certificate of Verification	Nonresidential Duct Leakage Measurement – Complete	

Document Number	Document Type	Document Description	Document Configuration Rules
		Replacement or Altered Duct System	Provider and certified Acceptance Test Technician may perform the duct leakage verification as provided in the Reference Appendices NA1.9. The results of the acceptance test may be used to satisfy the condition of compliance. Systems verified under this procedure are not eligible for sampling.
NRCV-MCH-04e-H	Certificate of Verification	Nonresidential Duct Leakage Measurement – Sealing of All Accessible Leaks Using Smoke Test	
NRCV-MCH-24a-H	Certificate of Verification	Enclosure Air leakage Worksheet – Single Point Test with Manual Meter	MCH-24 doc only used if called for by NRCV-MCH-27 docs.
NRCV-MCH-24b-H	Certificate of Verification	Enclosure Air Leakage Worksheet – Single Point Test with Automatic Meter	
NRCV-MCH-27b-H	Certificate of Verification	IAQ and Mechanical Ventilation – High-Rise Residential Multifamily Ventilation	When building type is high-rise residential, prompt the user to declare whether a MCH-27 is needed. If

Document Number	Document Type	Document Description	Document Configuration Rules
NRCV-MCH-27c-H	Certificate of Verification	IAQ and Mechanical Ventilation – High-Rise Residential Multifamily Ventilation – Scheduled or Real-Time Control	needed, require one NRCV-MCH-27 per dwelling unit.
NRCV-MCH-32-H	Certificate of Verification	Local Mechanical Exhaust – Kitchen Range Hood	If the building type specified on the NRCC is high-rise residential, and if the dwelling unit has a kitchen, then require one MCH-32 for the dwelling unit.
NRCV-PLB-21-H	Certificate of Verification	Nonresidential High-Rise Multifamily Central Hot Water System Distribution (HERS)	When HERS verification is required by NRCC, provide one NRCV-PLB-21 for the building.
NRCV-PLB-22-H	Certificate of Verification	Nonresidential High-Rise Single Dwelling Unit Hot Water System Distribution (HERS)	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 *2019 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 *2019 Reference Residential Appendix RA2*. Relevant sections from 2019 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 2019 Residential Appendix RA2

7.2.1.1 Designation of Groups (from 2019 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 2019 RA2.6.3.2)

Registration of the first Certificate of Installation, for the first dwelling in a sample group shall be required to "open" a new group. The date of the responsible person's registration

signature for the first Certificate of Installation for the group shall establish the start date for the group. Additional dwellings may be entered into the registry and included in an "open" group over a period of time subject to registration of the Certificate of Installation documents 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 after the start date of the 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 2019 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 2019 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 2019 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 RG 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 2019 Compliance Documents and HERS Features

Additional guidance for specific 2019 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 2019 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
CF1R-ENV-05-E	Prescriptive Certificate of Compliance	Fenestration Certificate of Compliance for residential use of NA-6 Fenestration U-Value and SHGC center of glass	sampling n/a

CF1R-ENV-06-E	Prescriptive Certificate of Compliance	Interior and Exterior Insulation Layers Worksheet	sampling n/a
CF1R-PLB-01-E	Prescriptive Certificate of Compliance	Hydronic Heating System Worksheet	sampling n/a
CF1R-STH-01-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; Ventilation; Cool Roofs	sampling n/a

CF2R/CF3R-ENV-20a-H	Certificate of Installation/Verification	Enclosure Air Leakage Single-Point Test with Manual Meter	**Envelope Leakage Feature** When the CF1R-PRF indicates requirement for Envelope Leakage HERS verification for the dwelling, then compliance may be demonstrated using either one of the applicable ENV-20 variants (a, b). 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.
CF2R/CF3R-ENV-20b-H	Certificate of Installation/Verification	Enclosure Air Leakage Single-Point Test with Automatic Meter	
CF2R/CF3R-ENV-21-H	Certificate of Installation/Verification	Quality Insulation Installation (QII) Air Infiltration Sealing Framing Stage	**QII Feature** There are no sampling procedures for multifamily

CF2R/CF3R-ENV-22-H	Certificate of Installation/Verification	Quality Insulation Installation (QII) Insulation Stage	buildings. QII verifications are not applicable to individual dwelling units in a multifamily building. When the CF1R indicates HERs verification is required for a multifamily building, one ENV-21 and one ENV-22 shall be required for the multifamily building. For single family dwellings, if the CF1R indicates requirement for HERS verification of QII, then compliance shall be demonstrated using one HERS "Tested" ENV-21 in one of the dwellings in the group, and one HERS "Tested" ENV-22 either in the same dwelling or otherwise in another dwelling in same sample group. Refer to group sampling procedures in RA2.6.3.5 that allow

			HERS verification "testing" of QII features prior to closing the sample group.
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
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-01d-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Performance Compliance for Additions and Alterations, or Addition Alone	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

CF2R/CF3R-MCH-20a-H	Certificate of Installation/Verification	Duct Leakage Measurement New System	**Duct Leakage Feature** When the MCH-01 indicates a MCH-20 is required for HERS verification of duct leakage for a ducted indoor unit 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
CF2R/CF3R-MCH-20b-H	Certificate of Installation/Verification	Duct Leakage Measurement Low Leakage Ducts in Conditioned Space Compliance Credit;	
CF2R/CF3R-MCH-20c-H	Certificate of Installation/Verification	Duct Leakage Measurement Low Leakage Air-Handling Units	
CF2R/CF3R-MCH-20d-H	Certificate of Installation/Verification	Duct Leakage Measurement Altered (Existing) System	

CF2R/CF3R-MCH-20e-H	Certificate of Installation/Verification	Duct Leakage Measurement Sealing of All Accessible Leaks	same variant does not need to be used on all indoor units on all systems in all dwellings in a sample group, thus any combination of MCH-20 variants can be used to qualify the dwelling to be in the same sample group. Dwellings containing multiple split systems that have both ducted and ductless indoor units connected to a common outdoor unit may be included in the same sample group along with systems that are entirely ducted or entirely ductless; and any combination of applicable MCH-20 variants may be used to verify those ducted indoor units. If MCH-20e (smoke test) is used for compliance in the dwelling, or if MCH-20d Section C requires use of a smoke test for verification of ducts

			in a garage space in the dwelling, then the systems in the dwelling that require duct leakage verification must be verified by a HERS rater; thus that dwelling shall not be allowed to comply as a "not tested" dwelling in a sample group, and the dwelling shall not be allowed to be used to represent the "tested" dwelling for duct leakage compliance for the sample group.

CF2R/CF3R-MCH-21-H	Certificate of Installation/Verification	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.
CF2R/CF3R-MCH-22a-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) Newly Installed Non-Zoned or Zoned Multi-Speed Compressor Systems	**Fan Efficacy Feature** When the MCH-01 indicates requirement for MCH-22 for HERS

CF2R/CF3R-MCH-22b-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) Newly Installed Zoned Single Speed Compressor Systems	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, c, d), 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.
CF2R/CF3R-MCH-22c-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) Newly Installed Non-Zoned or Zoned Multi-Speed Compressor Systems with CFVCS	
CF2R/CF3R-MCH-22d-H	Certificate of Installation/Verification	Forced Air System Fan Efficacy (Watt/cfm) Newly Installed Zoned Single Speed Compressor Systems with CFVCS	
CF2R/CF3R-MCH-23a-H	Certificate of Installation/Verification	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
CF2R/CF3R-MCH-23b-H	Certificate of Installation/Verification	Forced Air System Airflow Rate (cfm/ton) Zonally Controlled Systems in Every Zonal Control Mode	

CF2R/CF3R-MCH-23c-H	Certificate of Installation/Verification	Forced Air System Airflow Rate Alternative Compliance (best-that-I-can-do)	demonstrated using any one of the applicable variants (a, b, c, e, f), 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
CF2R/CF3R-MCH-23d-H	Certificate of Installation/Verification	Forced Air System Airflow Rate Measurement Only (CFM) Single Zone Systems or Zonally Controlled Systems with All Zones Calling	
CF2R/CF3R-MCH-23e-H	Certificate of Installation/Verification	Forced Air System Airflow Rate Newly Installed Non-Zoned or Zoned Multi-Speed Compressor with CFVCS	

CF2R/CF3R-MCH-23f-H	Certificate of Installation/Verification	Forced Air System Airflow Rate Newly Installed Zoned Single Speed Compressor Systems with CFVCS	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. A MCH-23d doc shall not be used for determining dwelling qualification for HERS Sample groups.
CF2R/CF3R-MCH-24a-H	Certificate of Installation/Verification	Enclosure Air Leakage Worksheet Single-Point Test with Manual Meter	MCH-24 does not document an applicable sampling feature by itself

CF2R/CF3R-MCH-24b-H	Certificate of Installation/Verification	Enclosure Air Leakage Worksheet Single-Point Test with Automatic Meter	(MCH-24 is used for completing some MCH-27 docs). A MCH-24 doc shall not be used for determining dwelling qualification for HERS Sample groups.
CF2R/CF3R-MCH-25a-H	Certificate of Installation/Verification	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-
CF2R/CF3R-MCH-25b-H	Certificate of Installation/Verification	Refrigerant Charge Verification Subcooling Method (Standard Charge Procedure)	
CF2R/CF3R-MCH-25c-H	Certificate of Installation/Verification	Refrigerant Charge Verification Weigh-in Charging Procedure	
CF2R/CF3R-MCH-25d-H	Certificate of Installation/Verification	Refrigerant Charge Verification - Fault Indicator Display (FID) (embedded in the CF2R MCH-25a,b,e) (standalone CF3R-MCH-25d)	
CF2R/CF3R-MCH-25e-H	Certificate of Installation/Verification	Refrigerant Charge Verification Winter Setup	
CF2R-MCH-25f-E	Certificate of Installation	Refrigerant Charge Verification - Packaged System Manufacturer	

		Refrigerant Charge Certification (CF2R only for the f variant)	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.

CF2R/CF3R-MCH-26-H	Certificate of Installation/Verification	Rated Space Conditioning System Equipment Verification	**Rated Space Conditioning System Feature** When the MCH-01 indicates requirement for MCH-26 for HERS verification of space conditioning systems 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.
CF2R/CF3R-MCH-27a-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation Single Family Attached/Detached Ventilation	**IAQ Mechanical Ventilation Feature** When MCH-27 for HERS verification for

CF2R/CF3R-MCH-27b-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation Multifamily Ventilation	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
CF2R/CF3R-MCH-27c-H	Certificate of Installation/Verification	IAQ and Mechanical Ventilation Single Family and Multifamily – Scheduled and Real-Time Control	
CF2R-MCH-27d-H	Certificate of Installation	IAQ and Mechanical Ventilation Non-Dwelling Unit	

CF2R/CF3R-MCH-28-H	Certificate of Installation/Verification	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** If specified 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, thus the system qualifies for inclusion in a sample group for airflow rate and Fan Efficacy Features.

CF2R/CF3R-MCH-29-H	Certificate of Installation/Verification	Supply Duct Surface Area and R-Value; Buried Ducts; Deeply Buried Ducts	**Duct Design Features** If the MCH-01 specifies requirement for MCH-29 for HERS verification for Duct Surface Area and R-Value and Buried or Deeply Buried Ducts Features in the dwelling, then 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.

CF2R/CF3R-MCH-30-H	Certificate of Installation/Verification	Central Fan Ventilation Cooling Systems (CFVCS) compliance credit	**CFVCS Feature** If the MCH-01 specifies requirement for MCH-30 for verification of central fan ventilation cooling systems (CFVCS) in the dwelling, then qualification for inclusion in a sample group may be demonstrated using MCH-30 regardless of which type of CFVCS is documented on the MCH-30. The same CFVCS verification protocol do not need to be used on all systems 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.
CF2R/CF3R-MCH-31a-H	Certificate of Installation/Verification	HERS verified WHF with individual CFM and Watts collection	**Whole House Fan (WHF) Airflow and Fan Efficacy** If MCH-31 for HERS verification for WHF verification is
CF2R/CF3R-MCH-31b-H	Certificate of Installation/Verification	HERS verified WHF with total CFM and individual Watts collection	

CF2R/CF3R-MCH-31c-H	Certificate of Installation/Verification	HERS verified WHF with individual CFM and total Watts collection	required for the dwelling, then 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-31 variants can be used to qualify to be in the same sample group
CF2R/CF3R-MCH-31d-H	Certificate of Installation/Verification	HERS verified WHF with total CFM and Watts collection	
CF2R/CF3R-MCH-32-H	Certificate of Installation/Verification	Local Mechanical Exhaust	**Kitchen Range Hood Verification** If HERS verification of the kitchen range hood is required for the dwelling, then the MCH-32 may be used as qualification for inclusion in a sample group.

CF2R/CF3R-MCH-33-H	Certificate of Installation/Verification	VCHP Compliance Credit	**VCHP Feature** If the MCH-01 indicates requirement for MCH-33 for HERS verification of variable capacity heat pump (VCHP) system in the dwelling, then qualification for inclusion in a sample group may be demonstrated using a MCH-33 regardless of which VCHP system type (ducted, ductless, ducted+ductless, non-continuous fan, continuous fan) is documented on the MCH-33. The same combination of MCH-33 compliance protocols do not need to be used for all MCH-33-documented systems in all dwelling units in a sample group, thus any combination of MCH-33 verifications can be used to qualify to be in the same sample group with

			other MCH-33-documented systems.
CF2R-MCH-34-E	Certificate of Installation	Pre-Cooling Credit	sampling n/a
CF2R-PLB-01a-E	Certificate of Installation	Multifamily Central Hot Water System Distribution - Non-HERS	sampling n/a
CF2R-PLB-01b-E	Certificate of Installation	NEEA Certified Heat Pump Water Heater Multifamily Central Hot Water System Distribution - Non-HERS	sampling n/a
CF2R-PLB-02a-E	Certificate of Installation	Single Dwelling Unit Hot Water System Distribution - Non-HERS	sampling n/a
CF2R-PLB-02b-E	Certificate of Installation	NEEA Certified Heat Pump Water Heater 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

CF2R/CF3R-PLB-21a-H	Certificate of Installation/Verification	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 HERS verification for multifamily DHW in the dwelling, qualification for inclusion in a sample group may be demonstrated using PLB-21a regardless of which verification protocol is reported on the PLB-21a. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-21a verifications can be used to qualify to be in the same sample group.

CF2R/CF3R-PLB-21b-H	Certificate of Installation/Verification	HERS - NEEA Certified Heat Pump Water 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 HERS verification for multifamily DHW in the dwelling, qualification for inclusion in a sample group may be demonstrated using PLB-21b regardless of which verification protocol is reported on the PLB-21b. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-21b verifications can be used to qualify to be in the same sample group.

CF2R/CF3R-PLB-22a-H	Certificate of Installation/Verification	HERS - Single Dwelling Unit Hot Water System Distribution	**SFD DHW Feature** When the CF1R indicates requirement for HERS verification for single family dwelling DHW feature, qualification for inclusion in a sample group may be demonstrated using PLB-22a regardless of which verification protocol is reported on the PLB-22a. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-22a verifications can be used to qualify to be in the same sample group.

CF2R/CF3R-PLB-22b-H	Certificate of Installation/Verification	HERS - NEEA Certified Heat Pump Water Single Dwelling Unit Hot Water System Distribution	**SFD DHW Feature** When the CF1R indicates requirement for HERS verification for single family dwelling DHW feature, qualification for inclusion in a sample group may be demonstrated using PLB-22b regardless of which verification protocol is reported on the PLB-22b. The same DHW verification protocol does not need to be used in all dwellings in a sample group, thus any combination of PLB-22b verifications can be used to qualify to be in the same sample group.
CF2R-PVB-01a-E	Certificate of Installation	Photovoltaic Systems	sampling n/a
CF2R-PVB-02-E	Certificate of Installation	Battery Storage Systems	sampling n/a
CF2R-SRA-01-E	Certificate of Installation	Solar Ready Buildings	sampling n/a
CF2R-SRA-02-E	Certificate of Installation	Minimum Solar Zone Area Worksheet	sampling n/a
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 the NRCC requires HERS verification of duct leakage 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 a "not tested" system in a sample group), additionally the
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-MCH-04e-documented system cannot be used to represent the "tested" system for duct leakage compliance for the sample group.
NRCV-MCH-24a-H	Certificate of Verification	Enclosure Air Leakage Worksheet – Single Point Test with Manual Meter	MCH-24 does not document an applicable sampling feature by itself (MCH-24 is used for completing some MCH-27 docs). A MCH-24 doc shall not be used for determining dwelling qualification for HERS Sample groups.
NRCV-MCH-24b-H	Certificate of Verification	Enclosure Air Leakage Worksheet – Single Point Test with Automatic Meter	

NRCV-MCH-27b-H	Certificate of Verification	IAQ and Mechanical Ventilation – High Rise Residential	**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 (b, c). 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.
NRCV-MCH-27c-H	Certificate of Verification	IAQ and Mechanical Ventilation – High Rise Residential Scheduled and Real Time Controls	
NRCV-MCH-32-H	Certificate of Verification	Local Mechanical Exhaust	**Kitchen Range Hood Verification** If HERS verification of the kitchen range hood is required for the dwelling, then the MCH-32 may be used as qualification for inclusion in a sample group.

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 2019-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://github.com/california-energy-commission/2019-HERS-Documents-Schema/tree/master/CEC-Documents

2019-CF1R-ADD-01-E-PrescriptiveAdditionsBuilding.docx
2019-CF1R-ALT-01-E-PrescriptiveAlterationsBuilding.docx
2019-CF1R-ALT-02-E-PrescriptiveAlterationsHVAC.docx
2019-CF1R-ENV-02-E-AreaWeightedAverageWorkSheet.docx
2019-CF1R-ENV-03-E-ShgcWorkSheet.docx
2019-CF1R-ENV-04-E-CoolRoofAndSRIWorksheet.docx
2019-CF1R-ENV-05-E-AlternativeDefaultFenestrationProcedure.docx
2019-CF1R-ENV-06-E-InteriorExteriorInsulationWorksheet.docx
2019-CF1R-NCB-01-E-PrescriptiveNewlyConstructedBuilding.docx
2019-CF1R-PLB-01-E-HydronicHeatingSystemWorksheet.docx
2019-CF1R-STH-01-E-OG100 Solar Water Heating Systems Worksheet.docx
2019-CF2R-ENV-01-FenestrationInstallation.docx
2019-CF2R-ENV-03-InsulationInstallation.docx
2019-CF2R-ENV-04-Roofing-RadiantBarrier.docx
2019-CF2R-ENV-20a-EnclosueAirLeakage-SinglePointTest-Manual Meter.docx
2019-CF2R-ENV-20b-EnclosureAirLeakage-SinglePointTest-Automatic Meter.docx
2019-CF2R-ENV-21-HERS-QII-FramingStage.docx
2019-CF2R-ENV-22-HERS-QII-InsulationStage.docx
2019-CF2R-LTG-01-E-Lighting–SingleFamilyDwellings.docx
2019-CF2R-LTG-02-E-Lighting–MultiFamilyDwellings.docx
2019-CF2R-MCH-01a-SpaceConditioningSystem-Performance.docx
2019-CF2R-MCH-01b-SpaceConditioningSystem-PrescriptiveAlterations.docx
2019-CF2R-MCH-01c-SpaceConditioningSystem-PrescriptiveNCB.docx
2019-CF2R-MCH-01d-SpaceConditioningSystem-Performance-E+A+A.docx
2019-CF2R-MCH-02-WholeHouseFan.docx

2019-CF2R-MCH-04-EvaporativeCoolers.docx
2019-CF2R-MCH-20a-DuctLeakageTest-NewConst.docx
2019-CF2R-MCH-20b-DuctLeakage-LLDCS.docx
2019-CF2R-MCH-20c-DuctLeakage-LLAHU.docx
2019-CF2R-MCH-20d-DuctLeakageTest-ExistingConst.docx
2019-CF2R-MCH-20e-DuctleakageTest-SealingAccesibleLeaks.docx
2019-CF2R-MCH-21-DuctLocation.docx
2019-CF2R-MCH-22a-FanEfficacy-AllZonesCallingOnly.docx
2019-CF2R-MCH-22b-FanEfficacy-EveryZonalControlMode.docx
2019-CF2R-MCH-22c-FanEfficacy-AllZonesCallingOnly-WithCFVCS.docx
2019-CF2R-MCH-22d-FanEfficacy-EveryZonalControlMode-WithCFVCS.docx
2019-CF2R-MCH-23a-AirflowRate-AllZonesCallingOnly.docx
2019-CF2R-MCH-23b-AirflowRate-EveryZonalControlMode.docx
2019-CF2R-MCH-23c-AirflowRate-BestThatIcanDo.docx
2019-CF2R-MCH-23d-AirflowRate-MeasurementOnly-AllZonesCallingOnly.docx
2019-CF2R-MCH-23e-AirflowRate-AllZonesCallingOnly-WithCFVCS.docx
2019-CF2R-MCH-23f-AirflowRate-EveryZonalControlMode-WithCFVCS.docx
2019-CF2R-MCH-24a-EnclosureAirLeakageWorksheet-SinglePointTest-Manual Meter.docx
2019-CF2R-MCH-24b-EnclosureAirLeakageWorksheet-SinglePointTest-Automatic Meter.docx
2019-CF2R-MCH-25a-RefrigerantCharge-Superheat.docx
2019-CF2R-MCH-25b-RefrigerantCharge-Subcooling.docx
2019-CF2R-MCH-25c-RefrigerantCharge-WeighInObservation.docx
2019-CF2R-MCH-25e-RefrigerantCharge-WinterSetup.docx
2019-CF2R-MCH-25f-RefrigerantCharge-PackagedSystemManufacturerCert.docx
2019-CF2R-MCH-26-RatedSystemVerification.docx
2019-CF2R-MCH-27a-SingleFamilyAttachedDetachedVentilation.docx
2019-CF2R-MCH-27b-Multifamily.docx
2019-CF2R-MCH-27c-SinglefamilyMultifamilyScheduledandRealTimeControl.docx
2019-CF2R-MCH-27d-NondwellingUnit.docx
2019-CF2R-MCH-28-ReturnDuctAndFilterGrilleDesign-Table150.0-BorC.docx
2019-CF2R-MCH-29-SupplyDuctSurfaceAreaBuriedDucts.docx
2019-CF2R-MCH-30-VentilationCooling.docx
2019-CF2R-MCH-31a-H-WholeHouseFanHERS-AirflowandWattsperWHF.docx
2019-CF2R-MCH-31b-H-WholeHouseFanHERS-AirflowperWHFandTotalWatts.docx
2019-CF2R-MCH-31c-H-WholeHouseFanHERS-TotalAirflowandWattsperWHF.docx
2019-CF2R-MCH-31d-H-WholeHouseFanHERS-TotalAirflowandWatts.docx
2019-CF2R-MCH-32-KitchenVentilation.docx
2019-CF2R-MCH-33-VchpComplianceCredit.docx
2019-CF2R-MCH-34-Pre-Cooling.docx
2019-CF2R-PLB-02a-NonHERS-SingleDwellingUnitHotWaterSystemDistribution.docx
2019-CF2R-PLB-02b-NonHERS-SingleDwellingDistNEEA.docx
2019-CF2R-PLB-03-PoolAndSpaHeatingSystems.docx
2019-CF2R-PLB-21a-HERS-MultifamilyCentralHotWaterSystemDistribution.docx
2019-CF2R-PLB-21b-HERS-MultifamilyCentralDistNEEA.docx
2019-CF2R-PLB-22a-HERS-SingleDwellingUnitHotWaterSystemDistribution.docx

2019-CF2R-PLB-22b-HERS-SingleDwellingDistNEEA.docx
2019-CF2R-PVB-01-E-PV Systems.docx
2019-CF2R-PVB-02-E-BatteryStorageSystems.docx
2019-CF2R-SRA-01-E-SolarReadyBuildings.docx
2019-CF2R-SRA-02-E-MinimumSolarZoneAreaWorksheet.docx
2019-CF2R-STH-01-SolarWaterHeatingSystems.docx
2019-CF3R-ENV-20a-EnclosureAirLeakage-SinglePointTest-Manual Meter.docx
2019-CF3R-ENV-20b-EnclosureAirLeakage-SinglePointTest-Automatic Meter.docx
2019-CF3R-ENV-21-HERS-QII-FramingStage.docx
2019-CF3R-ENV-22-HERS-QII-InsulationStage.docx
2019-CF3R-EXC-20-HERS-VerificationOfExistingConditionsForAlterations.docx
2019-CF3R-MCH-20a-DuctLeakageTest-NewConst.docx
2019-CF3R-MCH-20b-DuctLeakage-LLDCS.docx
2019-CF3R-MCH-20c-DuctLeakage-LLAHU.docx
2019-CF3R-MCH-20d-DuctLeakageTest-ExistingConst.docx
2019-CF3R-MCH-20e-DuctleakageTest-SealingAccesibleLeaks.docx
2019-CF3R-MCH-21-DuctLocation.docx
2019-CF3R-MCH-22a-FanEfficacy-AllZonesCallingOnly.docx
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2019-CF3R-MCH-22c-FanEfficacy-AllZonesCallingOnly-WithCFVCS.docx
2019-CF3R-MCH-22d-FanEfficacy-EveryZonalControlMode-WithCFVCS.docx
2019-CF3R-MCH-23a-AirflowRate-AllZonesCallingOnly.docx
2019-CF3R-MCH-23b-AirflowRate-EveryZonalControlMode.docx
2019-CF3R-MCH-23c-AirflowRate-BestThatIcanDo.docx
2019-CF3R-MCH-23d-AirflowRate-MeasurementOnly-AllZonesCallingOnly.docx
2019-CF3R-MCH-23e-AirflowRate-AllZonesCallingOnly-WithCFVCS.docx
2019-CF3R-MCH-23f-AirflowRate-EveryZonalControlMode-WithCFVCS.docx
2019-CF3R-MCH-24a-EnclosureAirLeakageWorksheet-SinglePointTest-Manual Meter.docx
2019-CF3R-MCH-24b-EnclosureAirLeakageWorksheet-SinglePointTest-Automatic Meter.docx
2019-CF3R-MCH-25a-RefrigerantCharge-Superheat.docx
2019-CF3R-MCH-25b-RefrigerantCharge-Subcooling.docx
2019-CF3R-MCH-25c-RefrigerantCharge-Weighin.docx
2019-CF3R-MCH-25d-RefrigerantCharge-FID.docx
2019-CF3R-MCH-25e-RefrigerantCharge-WinterSetUp.docx
2019-CF3R-MCH-26-RatedSystemVerification.docx
2019-CF3R-MCH-27a-ContinuousMechVent-FanVentRateMethod.docx
2019-CF3R-MCH-27b-ContinuousMechVent-TotalVentRateMethod.docx
2019-CF3R-MCH-27c-SinglefamilyMultifamilyScheduledandRealTimeControl.docx
2019-CF3R-MCH-28-ReturnDuctAndFilterGrilleDesign-Table150.0-BorC.docx
2019-CF3R-MCH-29-SupplyDuctSurfaceAreaBuriedDucts.docx
2019-CF3R-MCH-30-VentilationCooling.docx
2019-CF3R-MCH-31a-H-WholeHouseFanHERS-AirflowandWattsperWHF.docx
2019-CF3R-MCH-31b-H-WholeHouseFanHERS-AirflowperWHFandTotalWatts.docx
2019-CF3R-MCH-31c-H-WholeHouseFanHERS-TotalAirflowandWattsperWHF.docx
2019-CF3R-MCH-31d-H-WholeHouseFanHERS-TotalAirflowandWatts.docx

2019-CF3R-MCH-32-KitchenVentilation.docx
2019-CF3R-MCH-33-VchpComplianceCredit.docx
2019-CF3R-PLB-21b-HERS-MultifamilyCentralDistNEEA.docx
2019-CF3R-PLB-22a-HERS-SingleDwellingUnitHotWaterSystemDistribution.docx
2019-CF3R-PLB-22b-NonHERS-SingleDwellingDistNEEA.docx
2019-NRCV-MCH-04a-DuctLeakageTest-NewConst.docx
2019-NRCV-MCH-04c-DuctLeakage-LLAHU.docx
2019-NRCV-MCH-04d-DuctLeakageTest-ExistingConst.docx
2019-NRCV-MCH-04e-DuctleakageTest-SealingAccesibleLeaks.docx
2019-NRCV-MCH-24a-EnclosureAirLeakageWorksheet-SinglePointTest-ManualMeter.docx
2019-NRCV-MCH-24b-EnclosureAirLeakageWorksheet-SinglePointTest-AutomaticMeter.docx
2019-NRCV-MCH-27b-HighriseResidential.docx
2019-NRCV-MCH-27c-HighriseResidentialScheduledRealTimeControl.docx
2019-NRCV-MCH-32-LocalMechanicalExhaust.docx
2019-NRCV-PLB-21-HERS-HighRiseMultifamilyCentralHotWaterSystemDistribution.docx
2019-NRCV-PLB-22-HERS-HighRiseSingleDwellingUnitHotWaterSystemDistribution.docx

The contents of the file named 2019-CF2R-MCH-01b-SpaceConditioningSystem-PrescriptiveAlterations.docx follows.

STATE OF CALIFORNIA
SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CEC-CF2R-MCH-01-H (Revised 01/19) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 1 of 7)
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 (Btu/h)		08	Calculated Dwelling Unit Heating Load (Btu/h)	
09	Dwelling Unit Number of Bedrooms				

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

B. Space Conditioning (SC) System Information

01	02	03	04	05	06	07	08	09	10
SC System ID/Name from CF1R	SC System Description of 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

Notes:

Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2019 Residential Compliance January 2019

STATE OF CALIFORNIA

SPACE CONDITIONING SYSTEMS DUCTS AND FANS

CEC-CF2R-MCH-01-H (Revised 01/19) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		CF2R-MCH-01-E
Space Conditioning Systems, Ducts, and Fans		(Page 2 of 7)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

C. Space Conditioning (SC) System Alterations Compliance Information

01	02	03	04	05	06	07	08	09	10	11	12	13	14
SC System ID/Name from CF1R	SC System Description of Area Served	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	Number of Indoor Units Connected to the System's Outdoor Unit	Number of Ducted Indoor Units Connected to the System's Outdoor Unit	Central Fan Integrated (CFI) Ventilation System Status

Notes:

D. Installed Heating Equipment Information

01	02	03	04	05	06	07	08
SC System ID/Name from CF1R	SC System Description of Area Served	Heating Efficiency Type	Heating Efficiency Value	Heating Unit Manufacturer	Heating Unit Model Number	Heating Unit Serial Number	Rated Heating Capacity, Output (Btu/h)

Notes:

E. Installed Cooling Equipment Information:

01	02	03	04	05	06	07	08	09
SC System ID/Name from CF1R	SC System Description of Area Served	Cooling Efficiency Type	Cooling Efficiency Value	Condenser or Package Unit Manufacturer	Condenser or Package Unit Model Number	Condenser or Package Unit Serial Number	System Cooling Capacity at Design Conditions (Btu/h)	Condenser Nominal Capacity (ton)

Notes:

Registration Number: Registration Date/Time: HERS Provider:

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F. Altered Space Conditioning System Duct Information (<75% of duct system is altered; or duct system is not altered)

01	02	03	04	05	06	07	08	09	10	11	12
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Was Any New Ducting Installed?	Required New Duct R-Value	Installed New Supply Duct Location	Installed New Supply Duct R-Value	Installed New Return Duct Location	Installed New Return Duct R-Value	Exemption from Min R-Value	Can Approved Airflow Protocols be used to test this System?	Indoor Unit Nominal Cooling Capacity (ton)

Notes:

G. Installed New or Complete Replacement Duct System information

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Indoor Unit Total Duct Length	Required New Duct R-Value	Supply Duct Location	New or Replaced Supply Duct R-Value	Return Duct Location	New or Replaced Return Duct R-Value	Exemption from Min R-Value	Method of Compliance with Airflow and Fan Efficacy Req's in 150.0(m)13	Number of Air Filter Devices on Indoor Unit	Can Approved Airflow Protocols be used to test this System?	Can Approved Fan Efficacy Protocol be used to test this System?	Indoor Unit Nominal Cooling Capacity (ton)

Notes:

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H. Installed Air Filter Device Information

Mandatory requirements for air filter devices are specified Section 150.0(m)12. The installer shall place a sticker in or near the filter grille displaying the filter grille/rack design airflow rate and the maximum allowed clean filter pressure drop at the design airflow rate. This will inform the occupant of the airflow vs pressure drop performance required for replacement air filters.

01	02	03	04	05	06	07	08	09	10	11	12	13
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Air Filter Name or Description of Location	Air Filter Device Type	Design Airflow Rate for Air Filter Device (cfm)	Air Filter Nominal Depth (inch)	Air Filter Nominal Length (inch)	Air Filter Nominal Width (inch)	Air Filter Calculated Nominal Face Area (inch^2)	Air Filter Required Minimum Face Area (inch^2)	Face Area Compliance	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 shall be determined by the system designer. The system installer shall affix a sticker/label to each system air filter grille/rack location that discloses the filter's design airflow rate and the filter's maximum allowable clean-filter pressure drop at the design airflow rate. The sticker/label shall be permanently affixed to the air filter grille/rack, readily legible, and visible to a person replacing the air filter.
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 filters having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 µm range and equal to or greater than 85 percent in the 1.0-3.0 µm range when tested in accordance with AHRI Standard 680.
05	The system shall be provided with air filters that have been labeled by the manufacturer to disclose efficiency and pressure drop ratings that conform to the efficiency and pressure drop requirements for the air filter grilles/racks.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

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J. HERS Verification Requirements for Duct Systems

01	02	03	04	05	06	07	08	09
SC System Identification or Name	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Exemption From Duct Leakage Requirements	MCH-20 Duct Leakage Test	MCH-21 Duct Location Verification	MCH-22 AHU Fan Efficacy (W/cfm)	MCH-23 AHU Airflow Rate (cfm/ton)	MCH-28 Return Duct Design - Table 150.0-B or C

Notes:

K. HERS Verification Requirements for Space Conditioning Equipment

01	02	03
SC System ID/Name from CF1R	SC System Description of Area Served	MCH-25 Refrigerant Charge

Notes:

Registration Number: Registration Date/Time: HERS Provider:

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L. Space Conditioning Systems, Ducts and Fans – Mandatory Requirements and Additional Measures 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(c).
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: A liquid line filter drier shall be installed according to the manufacturer's specifications 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: The 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 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 otherwise a minimum of R-4.2 is allowed if the system is enclosed entirely in conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8. Exceptions for ducts in interior wall cavities or exposed ducts entirely in conditioned space are specified in Section 150.0(m)1B.
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.	

Registration Number: Registration Date/Time: HERS Provider:

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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 either: a) a responsible person 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, or b) I am an authorized representative of the responsible person and attest to the declarations in this statement on the responsible person's behalf.
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 Certificate of Compliance, plans, and specifications approved by the enforcement agency.
4. 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:

Registration Number: Registration Date/Time: HERS Provider:

CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS	CF2R-MCH-01-E
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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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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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C. Space Conditioning (SC) System Alterations Compliance Information

1 This field is filled out automatically. It is referenced from the previous section.

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

12 If the space conditioning system is a multiple-split system, then enter the total number of indoor units (ducted and ductless) connected to the outdoor unit.

13 If the space conditioning system is a multiple-split system, then enter the number of ducted indoor units (AHU) connected to the outdoor unit

14 If the indoor unit is used to bring outdoor air into the dwelling, the system may be used to comply with the IAQ mechanical ventilation requirements. This is called central fan integrated ventilation (CFI). Select CFI System if the system is used to provide IAQ ventilation.

D. Installed Heating Equipment Information

1. This field is filled out automatically. It is referenced from a previous section.
2. This field is filled out automatically. It is referenced from a previous section.
3. This field is filled out automatically. It is referenced from a previous section
4. 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.

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5. Enter the name of the *installed* Heating Unit Manufacturer as shown on the equipment nameplate.
6. Enter the name of the *installed* Heating Unit Model Number as shown on the equipment nameplate.
7. Enter the name of the *installed* Heating Unit Serial number as shown on the equipment nameplate.
8. 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 a previous section.
2. This field is filled out automatically. It is referenced from a previous section.
3. This field is filled out automatically. It is referenced from Section C.
4. 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.
5. Enter the name of the *installed* Condenser or Package Unit Manufacturer as shown on the equipment nameplate.
6. Enter the name of the *installed* Condenser or Package Unit Model Number as shown on the equipment nameplate.
7. Enter the name of the *installed* Condenser or Package Unit Serial Number as shown on the equipment nameplate.
8. Enter the sensible cooling capacity at design conditions of the *installed* cooling system in BTUs per hour.
9. Enter the *installed* Condenser 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 a previous section.
2. This field is filled out automatically. It is referenced from a previous section.
3. Enter a brief name or description of the indoor unit area served. Examples: Master Bedroom, Dining Room, Living Room, etc.
4. If any lengths of new ducts were installed, answer yes, otherwise if new ducts were not installed, answer no.
5. This field is filled out automatically based on values referenced from other sections.
6. Select the choice that best describes the predominant location of the supply ducts for this system
7. Enter the R-value of the *installed* supply ducts. This value is verified against the minimum value required by the standards. The installed R-value must be greater than or equal to the required minimum R-value.
8. Select the choice that best describes the predominant location of the return ducts for this system
9. Enter the R-value of the installed return ducts. This value is verified against the minimum value required by the standards. The installed R-value must be greater than or equal to the required minimum R-value
10. The duct system may be qualified for exemptions from the minimum R-value requirement if all of the ducts are located entirely within conditioned space. There are also exemptions for ducts located in interior wall cavities, and for ducts located entirely in conditioned space. The user may select from available choices to indicate the exemption. Note: Selecting Ducts ≥R4.2 entirely in conditioned space will subject the duct system to additional HERS verification
11. If the system is of a type that can use one of the approved protocols for testing the airflow rate, then enter yes. Otherwise enter no. Most ducted split systems and package systems are of the type that minimum airflow can be verified using an approved measurement procedure. Examples of systems that do not meet this description are ductless systems. A "No" response here may subject the project to additional scrutiny by enforcement personnel. Note: that the protocol in RA3.3.3.1.5 (Alternative to Compliance with Minimum System Airflow Requirements for Altered Systems) is not one of the protocols that is allowed to be used to justify a "yes" to this question.
12. Enter the indoor unit nominal cooling capacity (ton) if the indoor unit is a multiple-split system type, otherwise this field is not needed.

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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. Enter a brief name or description of the indoor unit area served. Examples: Master Bedroom, Dining Room, Living Room, etc..
4. Enter the description of the total combined length of the supply and return ducts on this indoor unit. The possible choices are: >10ft length, and ≤10ft length.
5. This field is filled out automatically. This is the minimum R-value for new ducts in this climate zone.
6. Select the choice that best describes the predominant location of the supply ducts for this system.
7. Enter the R-value of the *installed* supply ducts. This value is verified against the minimum value in G05. The installed R-value must be greater than or equal to the minimum R-value.
8. Select the choice that best describes the predominant location of the return ducts for this system.
9. 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.
10. The duct system may be qualified for exemptions from the minimum R-value requirement if all of the ducts are located entirely within conditioned space. There are also exemptions for ducts located in interior wall cavities, and for ducts located entirely in conditioned space. The user may select from available choices to indicate the exemption. Note: Selecting Ducts ≥R4.2 entirely in conditioned space will subject the duct system to additional HERS verification.
11. Pick the appropriate choice. Refer to section 150.0(m)13 of the 2019 Building Energy Efficiency Standards, and Section 4.4 of Chapter 4 of the 2019 Residential Compliance Manual for more information.
12. Specify the number of air filter devices installed on this indoor unit. 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.
13. If the system is of a type that can use one of the approved protocols for testing the airflow rate, then enter yes. Otherwise enter no. Most ducted split systems and package systems are of the type that minimum airflow can be verified using an approved measurement procedure. Examples of systems that do not meet this description are ductless systems. A "No" response here may subject the project to additional scrutiny by enforcement personnel. Note: that the protocol in RA3.3.3.1.5 (Alternative to Compliance with Minimum System Airflow Requirements for Altered Systems) is not one of the protocols that is allowed to be used to justify a "yes" to this question.
14. If the system is of a type that can use one of the approved protocols for testing the fan efficacy, then enter yes. Otherwise enter no.
15. Enter the indoor unit cooling capacity if the indoor unit is a multiple-split system type, otherwise this field is not needed.

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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. This field is filled out automatically. It is referenced from the same row and column in the previous sections.
4. 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.
5. Select the appropriate type of filter device from the list.
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 nominal depth of the filter in inches. This is the dimension that is parallel to the airflow. many filters available for sale are 1-inch depth. The 2019 standards encourage use of 2-inch depth filters.
8. Enter the nominal length of the filter. for example, if the filter is 20" x 30", enter 30.
9. Enter the nominal width of the filter, for example, if the filter is a 20" x 30", enter 20.
10. This field is calculated automatically based on your entries in 8 and 9.
11. This value is calculated automatically for 1-inch depth filters. 2-inch depth or greater filters may use a value determined by the system designer.
12. This field determines whether a 1-inch depth filter complies with the sizing requirements in section 150.0(m)12. A 2-inch depth or greater filter may use the face area determined by the system designer, however most systems have to meet airflow rate and fan efficacy requirements.
13. Enter the design static pressure drop determined by the system designer if 2-inch or greater filters are used. For 1-inch depth filters, the maximum pressure drop is mandatory 0.1 inch W.C.. Filters installed in the filter grille/rack must be capable of meeting this maximum pressure drop at the design airflow rate, as shown on the manufacturer's filter label. 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. This field is filled out automatically. It references previous sections in this document.
4. If applicable, select from the available exemptions listed. Exemptions will be flagged and may subject the system to additional enforcement scrutiny.
5. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
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.

K. HERS Verification Requirements for Space Conditioning Equipment

1. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
2. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.
3. This field is filled out automatically. It is calculated based on data from the CF1R and from previous sections in this document.

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L. 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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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 >>

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03	Dwelling Unit Total Conditioned Floor Area (ft²)	<<numeric: xxxxx; **if1 parent is CF1R-PRF, then** **if2 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 endif2** **elseif parent is CF1R-NCB-01, then** **if3 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** **if4 building type = Single Family, then** **reference value from CF1R-NCB field A10** **elseif Building Type=Multifamily, then** **reference value from CF1R-NCB field M02 endif4** **endif3** **elseif parent is CF1R-ADD-01, then** **if5 building type= Single Family, then** **reference value from field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ADD-01 Section J.** **elseif Building Type=Multifamily, then** **reference value from field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ADD-01 Section L endif5** **elseif parent is CF1R-ALT-01, then** **if6 building type= Single Family, then** **reference value from field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ALT-01 Section G.** **elseif Building Type=Multifamily, then** **reference value from field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ALT-01 Section letter I. endif6** **elseif parent is CF1R-ALT-02, then** **reference value from CF1R-ALT-02 field A08. endif1** 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 (field A10); 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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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 (Btu/h)	<<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 (Btu/h)	<<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 constrained to be greater than or equal to the default value from the CF1R-PRF, 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: if1 CertComplianceType=performance, then if2 CF1R-PRF Project Scope=one of the following two types: **Addition and/or Alteration **Newly Constructed - Addition Alone then display doc variation MCH-01d; elseif CF1R-PRF Project Scope=Newly Constructed, then display doc variation MECH01a endif2 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) endif1>>

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

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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 ID/Name from CF1R	SC System Description of Area Served	CFA served by this SC System (ft²):	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>>	<<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 Require each entry to be unique in this dwelling unit i.e. unique within the scope of this instance of the MCH-01>>	<<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 t; 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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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

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m	no	no	yes	no	no	yes	Entirely new space conditioning system	none	e.g. new ductless hydronic heating system
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
t	yes	yes	yes	no	yes	yes	Entirely new space conditioning system	RC + DctLk + FE/AF or Tbl150.0-C,D	e.g. new ducted system that has less than 40 ft of ducts

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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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	14
SC System ID/Name from CF1R	SC System Description of Area Served	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	Number of Indoor Units Connected to the System's Outdoor Unit	Number of Ducted Indoor Units Connected to the System's Outdoor Unit	Central Fan Integrated (CFI) Ventilation System Status
<<reference value from B01>>	<<reference value from B02>>	<< 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 mini-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; *non-air-source heat pump; *Wood Heat; *N/A (no heating); *Small duct high velocity HP; *Ductless VRF HP; *Packaged gas furnace*multisplit HP-ducted *multisplit HP-ductless *multisplit HP-ducted+ductless *no heating If value=no heating, then check: there must be at least one heating system entered in this section in column C04 to comply, else flag noncompliant condition (no heating installed) and do not allow registration to continue. 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 >>	<<if C04 = no heating component altered, then value =n/a elseif C03 = one of the following system types: *hydronic, *hydronic + forced air, *combined hydronic, *combined hydronic + forced air, *hydronic HP, *hydronic HP + forced air, thenvalue=NA; else reference value from CF1R as default; 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 >>	<<if C04 = no heating component altered, then value =n/a elseif C03 = one of the following system types: *hydronic, *hydronic + forced air, *combined hydronic, *combined hydronic + forced air, *hydronic HP, *hydronic HP + forced air, then value=NA; else reference value from CF1R as default; allow user to override the default to enter value: xx.x; note: default minimum value for AFUE=80; and default minimum value for HSPF=8.0; 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 mini-split AC; *ductless mini-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 *non-air-source heat pump; *non-air-cooled air conditioner; *no cooling; *Small duct high velocity HP; *Small duct high velocity AC *Ductless VRF HP; *Ductless VRF AC; *multisplit AC-ducted *multisplit AC-ductless *multisplit AC-ducted+ductless *multisplit HP-ducted *multisplit HP-ductless *multisplit HP-ducted+ductless 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 C08= 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 C08= 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=14; 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 as default display result: "setback" allow user to override the default and pick one from list: *setback; *Occupant Controlled Smart Thermostat (OCST) per JA5; *Energy Management Control System (EMCS)>> >>	<<if [C03 or C07] = one of the following system types: *room HP *gas wall furnace; *gas space heater; *electric ; *Wood Heat; *Packaged gas furnace *central packaged AC ; *central packaged HP *central large packaged AC ; *central large packaged HP *room AC; *room HP; *evaporative - direct *evaporative - Indirect *evaporative - Indirectdirect then text value=N/A, elseif C14=CFI System' then integer value=1, else default integer value =1; allow user to overwrite the default to enter one of the following two: 1: an integer value greater than 1, 2: text value=N/A >>	<<if B04=no, then text value = "n/a"; else default integer value =1; allow user to overwrite the default to enter an integer value greater than 1>>	<<user pick one from list: *CFI System *Not CFI>>

Notes:

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D. Installed Heating Equipment Information

<< If all systems listed in Section C have a value in C04= 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 C04= no heating component altered>>

01	02	03	04	05	06	07	08
SC System ID/Name from CF1R	SC System Description of Area Served	Heating Efficiency Type	Heating Efficiency Value	Heating Unit Manufacturer	Heating Unit Model Number	Heating Unit Serial Number	Rated Heating Capacity, Output (Btu/h)
<<reference value from B01>>	<<reference value from B02>>	<<reference value from C05>>	<<if C06 = NA, then report NA; Else user input, numeric, xx.x; check value must be ≥ value in C06, 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, xxxx>>

Notes:

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E. Installed Cooling Equipment Information:
<<if all of the SC Systems listed in Section C have a value in C07=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 one of the following two conditions: 1:[a value in C07=no cooling] or 2:[a value in C08 = no cooling component altered]>>

01	02	03	04	05	06	07	08	09
SC System ID/Name from CF1R	SC System Description of Area Served	Cooling Efficiency Type	Cooling Efficiency Value	Condenser or Package Unit Manufacturer	Condenser or Package Unit Model Number	Condenser or Package Unit Serial Number	System Cooling Capacity at Design Conditions (Btu/h)	Condenser Nominal Capacity (ton)
<<reference value from B01>>	<<reference value from B02>>	<<reference value from C09>>	<<user input, numeric, xx.x; check value must be ≥ value in C10 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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F. Altered Space Conditioning System Duct Information (<75% of duct system is altered; or duct system is not altered)

<<if there are no systems in Section B for which BOTH of the following two conditions are true: 1:[B04 = yes] 2:[the Alteration Type in column B10 equals one of the following two (Extension of Existing Duct System); (Altered Space Conditioning System)], then display the "section does not apply" message;

else for each SC System in Section B for which BOTH of the following two conditions are true: 1:[B04 = yes] 2:[the alteration type value in column B10 is equal to one of the following two: (Extension of Existing Duct System); (Altered Space Conditioning System)], do the following actions A, B, C:

A: require one row of data in this table for each space conditioning system in section D field D02 for which C03=Packaged Gas Furnace.
B: require one row in this table for each space conditioning system in section E field E02 that meets the following two conditions: 1:[value in C07= one of the packaged unit types (central packaged AC), (central large packaged AC), (central packaged HP), (central large packaged HP)], 2:[the same packaged unit is not already listed in section D thus D02≠E02];
C: for systems for which C13≥1, enter one row of data in this table for each of the quantity of ducted indoor units specified in C13 for that system>>

01	02	03	04	05	06	07	08	09	10	11	12
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Was Any New Ducting Installed?	Required New Duct R-Value	Installed New Supply Duct Location	Installed New Supply Duct R-Value	Installed New Return Duct Location	Installed New Return Duct R-Value	Exemption from Min R-Value	Can Approved Airflow Protocols be used to test this System?	Indoor Unit Nominal Cooling Capacity (ton)
<<reference value from B01>>	<<reference value from B02>>	<<if system type in C03=(Packaged Gas Furnace), then value auto filled from B02, elseif system type in (C03 or C07) = one of the following four types: 1: central packaged AC ; 2: central packaged HP ; 3: central large packaged AC ; 4: central large packaged HP then value auto filled from B02 elseif value in C12=1, then value autofilled from B02; else user input, text, 15 characters maximum; do not allow duplicate values for indoor unit names in this MCH-01 as listed in F03 and G03>>	<<user pick one of the following two text values: *yes *no>>	<<if F04=no, then value=n/a, elseif B07=no, then value = R-6, elseif A02=CZ 1-10, 12, 13, then value = R-6, elseif A02=CZ 11, 14-16 then value = R-8>>	<<if F04=no, then value=n/a, else user pick one from the following list: * conditioned space-entirely, *unconditioned attic, *unconditioned crawl space, *controlled ventilation crawl space *unconditioned garage, *unconditioned basement, *outdoors>>	<< if F04=no, then value=n/a, else user pick one value from the following list: *R-4.2, *R-6, *R-8, *R-10, *R-12; check value: must be ≥ value in F05 to comply subject to the following exception: if F10= *Ducts ≥R4.2 entirely in Conditioned Space, then R-4.2 complies. flag non-compliant values and do not allow registration to proceed if not in compliance.	<<if F04=no, then value=n/a, else user pick one from the following list: * conditioned space-entirely, *unconditioned attic, *unconditioned crawl space, *controlled ventilation crawl space *unconditioned garage, *unconditioned basement, *outdoors>>	<< if F04=no, then value=n/a, else user pick one value from the following list: *R-4.2, *R-6, *R-8, *R-10, *R-12; check value: must be ≥ value in F05 to comply subject to the following exception: if F10= *Ducts ≥R4.2 entirely in Conditioned Space, then R-4.2 complies. flag non-compliant values and do not allow registration to proceed if not in compliance.	<< if F04=no, then value=n/a, else default text value=No Exemption; allow user to override the default and select one or both of the following two values: **uninsulated ducts in wall cavity **uninsulated exposed ducts In directly conditioned space; ALSO if value in both F06 and F08= conditioned space-entirely, then also allow user to select the following value: **Ducts ≥R4.2 entirely in conditioned space	<<if system type in C03 or C07 is one of the following system types: *central split AC; *central split HP *central packaged AC ; *central packaged HP *central large packaged AC *central large packaged HP, then value=Yes, else user pick one of the following two values from list: **yes **no check: if value=no, then report in project status notes field that exemption from mandatory HERS verification of system airflow has been claimed. Enforcement agency confirmation is recommended.>>	<<if C12 > 1, and one of the following two are true: *J08=yes, *J05=yes then user input numeric value, x.xx, else text value=n/a>>
Notes:											

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G. Installed New or Complete Replacement Duct System information

<<if there are no SC Systems listed in Section B for which B08=yes, then display the section does not apply message;
else for each space conditioning system in Section B for which B08=yes, do the following actions A, B, C:
A: require one row of data in this table for each space conditioning system in section D field D02 for which C03=Packaged Gas Furnace.
B: require one row in this table for each space conditioning system in section E field E02 that meets BOTH of the following two conditions: 1:[value in C07= one of the packaged unit types: {central packaged AC}, {central large packaged AC}, {central packaged HP}, {central large packaged HP}], 2:[the same packaged unit is not already listed in section D thus D02=E02]:
C: for systems for which C13≥1,enter one row of data in this table for each of the quantity of ducted indoor units specified in C13 for that system>>

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Total Duct Length	Required New Duct R-Value	Supply Duct Location	New or Replaced Supply Duct R-Value	Return Duct Location	New or Replaced Return Duct R-Value	Exemption from Min R-Value	Method of Compliance with Airflow and Fan Efficacy Req's in 150.0(m)13	Number of Air Filter Devices on Indoor Unit	Can Approved Airflow Protocols be used to test this System?	Can Approved Fan Efficacy Protocol be used to test this System?	Indoor Unit Nominal Cooling Capacity (ton)
<<reference value from B01>>	<<auto filled from B02>>	<< If system type in C03=[Packaged Gas Furnace], then value auto filled from B02, elseif system type in C03 or C07 = one of the following four types: 1: central packaged AC ; 2: central packaged HP 3: central large packaged AC ; 4: central large packaged HP then value auto filled from B02 elseif value in C12=1, then value autofilled from B02; else user input, text, 15 characters maximum; do not allow duplicate values for indoor unit names in this MCH-01 as listed in F03 and G03>>	<<user pick one text value from the following 2: *[>10ft] *[≤10ft]>>	<<if A02= CZ 1-10, 12, 13, then value = R-6.; elseif A02=CZ 11, 14-16 then value = R-8>>	<<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-4.2 *R-6, *R-8, *R-10, *R-12; check value: must be ≥ value in G05 to comply subject to the following exception: if G10= *Ducts ≥R4.2 entirely in Conditioned Space, then R-4.2 complies; flag non-compliant values and do not allow registration to proceed if not in compliance>>	<<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-4.2 *R-6, *R-8, *R-10, *R-12; check value: must be ≥ value in G05 to comply subject to the following exception: if G10= *Ducts ≥R4.2 entirely in Conditioned Space, then R-4.2 complies flag non-compliant values and do not allow registration to proceed if not in compliance>>	<< Default Value=No Exemption; allow user to override the default and select one or more of the following two values: **uninsulated ducts in wall cavity **Uninsulated exposed ducts in directly conditioned space; ALSO if values in both G06 and G08= conditioned space-entirely then also allow user to select the following value: **Ducts ≥R4.2 entirely in conditioned space	<<if C07=no cooling, then text value = "Exempt - No Cooling"; elseif C07= one of the following three system types: **evaporative - direct, **evaporative - indirect, **evaporative - indirectdirect, then text value = "Exempt - Evaporative System"; elseif G13=no, then text value = "Exempt - Approved Protocols are N/A"; elseif B08=yes, AND C14=CFI System, then result = HERS Verified Fan Efficacy (W/cfm) and Airflow Rate(cfm/ton); else, user select one from the following two values: **[HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton)] **[HERS verified Return Duct Design per Table 150.0-B, C] >>	<<user enter integer value>> note: this value will determine number or rows per indoor unit in next section	<<if system type in C03 or C07 is one of the following system types: *central split AC; *central split HP *central packaged AC ; *central packaged HP *central large packaged AC *central large packaged HP, then value=Yes, else user pick one of the following two values from list: **yes **no check: If value=no, then report in project status notes field that exemption from mandatory HERS verification of system airflow has been claimed. Enforcement agency confirmation is recommended.>>	<<if system type in C03 or C07 is one of the following system types: *central split AC; *central split HP *central packaged AC ; *central packaged HP *central large packaged AC *central large packaged HP, then value=Yes, else user pick one of the following two values from list: **yes **no check: If value=no, then report in project status notes field that exemption from mandatory HERS verification of system fan efficacy has been claimed. Enforcement agency confirmation is recommended.>>	<<if C11≥ 1, and one of the following two are true: * J08=yes, * J05=yes then user input numeric value, x.xx, else text value= n/a>>
Notes:														

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H. Installed Air Filter Device Information

Mandatory requirements for air filter devices are specified Section 150.0(m)12. The installer shall place a sticker in or near the filter grille/rack displaying the filter grille/rack design airflow rate and the maximum allowed clean filter pressure drop at the design airflow rate. This will inform the occupant of the airflow vs pressure drop performance required for replacement air filters.

<<If Section G does not apply, **then** display the section does not apply message; **elseif** there are no duct systems in G03 that have a value in G04 equal to ">10ft", then display the section does not apply message;

else require one row of data (each) for the quantity of air filter devices in G12 for each of the duct systems listed in G03 for which the value in G04=[>10ft];

01	02	03	04	05	06	07	08	09	10	11	12	13
SC System ID/Name from CF1R	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Air Filter Name or Description of Location	Air Filter Device Type	Design Airflow Rate for Air Filter Device (cfm)	Air Filter Nominal Depth (inch)	Air Filter Nominal Length (inch)	Air Filter Nominal Width (inch)	Air Filter Calculated Nominal Face Area ($inch^2$)	Air Filter Required Minimum Face Area ($inch^2$)	Face Area Compliance	Design Allowable Pressure Drop for Air Filter Device (inch W.C.)
<<reference value from B01>>	<<auto filled from B02>>	<<auto filled from G03	<<user input text, maximum 20 characters>>	<<user select from list: *Filter Grille *Furnace Mounted *Duct Mounted >>	<<user enter value numeric; xxxx>>	<<user enter integer value ≥1>>	<<user enter integer value ≥1 >>	<<user enter integer value ≥1 >>	<<calculated numeric value= (H08*H09) >>	<<if H07=1, then calculated value=(H06 ÷ 150) *144, else display text value = "specified by system designer"	<<if value in H11= "specified by system designer", then display text value = "specified by system designer"; elseif H10≥H11, then display text: "complies", else display text:"does not comply">>	<<if value in H07=1, then value = 0.1; else user enter value, numeric, x.xx>>

Notes:

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I. Air Filter Device Requirements <<if section H does not apply, then display the section does not apply message; elseif Section H applies, then display section I.	
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 shall be determined by the system designer. The system installer shall affix a sticker/label to each system air filter grille/rack location that discloses the filter's design airflow rate and the filter's maximum allowable clean-filter pressure drop at the design airflow rate. The sticker/label shall be permanently affixed to the air filter grille/rack, readily legible, and visible to a person replacing the air filter.
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 filters having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 µm range and equal to or greater than 85 percent in the 1.0-3.0 µm range when tested in accordance with AHRI Standard 680.
05	The system shall be provided with air filters that have been labeled by the manufacturer to disclose efficiency and pressure drop ratings that conform to the efficiency and pressure drop requirements for the air filter grilles/racks.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

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J. HERS Verification Requirements for Duct Systems

<<if both sections F and G do not apply, then display the section does not apply message, else require one row of data in this table for each of the indoor units listed in F03; also require one row of data in this table for each of the indoor units listed in G03>>

01	02	03	04	05	06	07	08	09
SC System Identification or Name	SC System Description of Area Served	Indoor Unit Name or Description of Area Served	Exemption From Duct Leakage Requirements	MCH-20 Duct Leakage Test	MCH-21 Duct Location Verification	MCH-22 AHU Fan Efficacy (W/cfm)	MCH-23 AHU Airflow Rate (cfm/ton)	MCH-28 Return Duct Design - Table 150.0-B or C
<<reference value from B01>>	<<auto filled from B02>>	<<auto filled from F03 or G03 as applicable	<< calculated field: Default text Value= "No Exemptions"; allow user to override the default and pick one of the following three text values from list: * Ducts have previously been sealed, tested, and certified by a HERS rater; * Duct system has less than 40 ft of duct; * 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 J04 ≠ No Exemptions, then display result = no; elseif J04= 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 t; if the term "DctLk" appears in the HERS column, then display text result= "yes" in this field [duct leakage test required]; elsif the term "DctLk" does not appear in the HERS column, then display result= "no" in this field >>	<< Calculated field: if applicable value in either F10 or G10 = "Ducts 1R4.2 entirely in conditioned space, and one of the following two conditions is true: 1) applicable values in either G07 or G09 are < G05, 2) applicable values in either F07 or F09 are < F05, then display text result in this field="yes"; elseif applicable values in either F10 or G10= one of the following two: *[uninsulated ducts in wall cavity] *[Uninsulated exposed ducts in directly conditioned space], then text result="yes" else display text result="no">>	<< Calculated field: if G14=no then result=no elseif the value in G11= "HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton)", then display text result in this field="yes"; elseif all of the following five conditions are true: **B09=yes **C07=no cooling **C14=CFI System, **G13=yes, **G14=yes, then result= yes; else display text result="no">>	<< Calculated field: if the value in G11= "HERS Verified Fan Efficacy (W/cfm) and Airflow Rate (cfm/ton)", then display text result in this field="yes"; elseif the value in K03=yes, AND the value in J09=no, then text result in this field=yes elseif all of the following five conditions are true: **B09=yes **C07=no cooling **C14=CFI System, **G13=yes, **G14=yes, then result= yes; else display text result="no">>	<< Calculated field: if the value in G11= [HERS verified Return Duct Design per Table 150.0-B, C]; then display text result in this field="yes"; else display text result="no">>
Notes:								

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K. HERS Verification Requirements for Space Conditioning Equipment
<<require one row of data in this table for each of the SC Systems listed in Section C>>

01	02	03
		MCH-25
SC System ID/Name from CF1R	SC System Description of Area Served	Refrigerant Charge
<<auto filled from B01>>	<<auto filled from B02>>	<< Calculated field: If [C07 or C08] = one of the following 2 values: *non-airsource heat pump *non-air-cooled air conditioner then result = no; else determine value 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 t; If the term "RC" appears in the HERS column, and A02 =one of the CZ values in the following list: 2, 8, 9, 10, 11, 12, 13, 14, 15, then display text result in this field = yes; else display result = no>>

Notes:

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L. Space Conditioning Systems, Ducts and Fans – Mandatory Requirements and Additional Measures 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(c).
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: A liquid line filter drier shall be installed according to the manufacturer's specifications 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: 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 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 otherwise a minimum of R-4.2 is allowed if the system is enclosed entirely in conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8. Exceptions for ducts in interior wall cavities or exposed ducts entirely in conditioned space are specified in Section 150.0(m)1B.
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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Space Conditioning Systems Ducts and Fans	(Page 17 of 17)

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 either: a) a responsible person 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, or b) I am an authorized representative of the responsible person and attest to the declarations in this statement on the responsible person's behalf.
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 Certificate of Compliance, plans, and specifications approved by the enforcement agency.
4. 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:

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://github.com/california-energy-commission/2019-HERS-Documents-Schema/tree/master/deployed/schema

CF1RADD01E.xsd
CF1RALT01E.xsd
CF1RALT02E.xsd
CF1RENV02E.xsd
CF1RENV03E.xsd
CF1RENV04E.xsd
CF1RENV05E.xsd
CF1RENV06E.xsd
CF1RNCB01E.xsd
CF1RPLB01E.xsd
CF1RSTH01E.xsd
PSR01E.xsd
CF2RENV03E.xsd
CF2RENV04E.xsd
CF2RENV20aH.xsd
CF2RENV20bH.xsd
CF2RENV21H.xsd
CF2RENV22H.xsd
CF2RLTG01E.xsd
CF2RLTG02E.xsd
CF2RMCH01aE.xsd
CF2RMCH01bE.xsd
CF2RMCH01cE.xsd
CF2RMCH01dE.xsd
CF2RMCH02E.xsd
CF2RMCH04E.xsd
CF2RMCH20aH.xsd
CF2RMCH20bH.xsd
CF2RMCH20cH.xsd
CF2RMCH20dH.xsd
CF2RMCH20eH.xsd

CF2RMCH21H.xsd
CF2RMCH22aH.xsd
CF2RMCH22bH.xsd
CF2RMCH22cH.xsd
CF2RMCH22dH.xsd
CF2RMCH23aH.xsd
CF2RMCH23bH.xsd
CF2RMCH23cH.xsd
CF2RMCH23dH.xsd
CF2RMCH23eH.xsd
CF2RMCH23fH.xsd
CF2RMCH24aH.xsd
CF2RMCH24bH.xsd
CF2RMCH25aH.xsd
CF2RMCH25bH.xsd
CF2RMCH25cH.xsd
CF2RMCH25dH.xsd
CF2RMCH25eH.xsd
CF2RMCH25fE.xsd
CF2RMCH26H.xsd
CF2RMCH27aH.xsd
CF2RMCH27bH.xsd
CF2RMCH27cH.xsd
CF2RMCH27dE.xsd
CF2RMCH28H.xsd
CF2RMCH29H.xsd
CF2RMCH30H.xsd
CF2RMCH31aH.xsd
CF2RMCH31bH.xsd
CF2RMCH31cH.xsd
CF2RMCH31dH.xsd
CF2RMCH32.Hxsd
CF2RMCH33H.xsd
CF2RMCH34E.xsd
CF2RPLB02aE.xsd
CF2RPLB02bE.xsd
CF2RPLB03E.xsd
CF2RPLB21aH.xsd
CF2RPLB21bH.xsd
CF2RPLB22aH.xsd
CF2RPLB22b.Hxsd
CF2RPVB01E.xsd
CF2RPVB02E.xsd
CF2RSRA01E.xsd
CF2RSRA02E.xsd

CF2RSTH01E.xsd
CF3RENV20aH.xsd
CF3RENV20bH.xsd
CF3RENV21H.xsd
CF3RENV22H.xsd
CF3REXC20H.xsd
CF3RMCH20aH.xsd
CF3RMCH20bH.xsd
CF3RMCH20cH.xsd
CF3RMCH20dH.xsd
CF3RMCH20eH.xsd
CF3RMCH21H.xsd
CF3RMCH22Ha.xsd
CF3RMCH22bH.xsd
CF3RMCH22cH.xsd
CF3RMCH22dH.xsd
CF3RMCH23aH.xsd
CF3RMCH23bH.xsd
CF3RMCH23cH.xsd
CF3RMCH23dH.xsd
CF3RMCH23eH.xsd
CF3RMCH23fH.xsd
CF3RMCH24aH.xsd
CF3RMCH24bH.xsd
CF3RMCH25aH.xsd
CF3RMCH25bH.xsd
CF3RMCH25cH.xsd
CF3RMCH25dH.xsd
CF3RMCH25eH.xsd
CF3RMCH26H.xsd
CF3RMCH27aH.xsd
CF3RMCH27bH.xsd
CF3RMCH27cH.xsd
CF3RMCH28H.xsd
CF3RMCH29H.xsd
CF3RMCH30H.xsd
CF3RMCH31aH.xsd
CF3RMCH31bH.xsd
CF3RMCH31cH.xsd
CF3RMCH31dH.xsd
CF3RMCH32H.xsd
CF3RMCH33H.xsd
CF3RPLB21bH.xsd
CF3RPLB22aH.xsd
CF3RPLB22bH.xsd

NRCV-MCH-04aH.xsd
NRCV-MCH-04cH.xsd
NRCV-MCH-04dH.xsd
NRCVMCH04eH.xsd
NRCVMCH24aH.xsd
NRCVMCH24bH.xsd
NRCVMCH27bH.xsd
NRCVMCH27cH.xsd
NRCVMCH32H.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.

```
H:\Git\
1   <?xml version="1.0" encoding="UTF-8"?>
2   <xsd:schema xmlns="http://www.lmonte.com/besm/CF2RMCH01bE"
    xmlns:altova="http://www.altova.com/xml-schema-extensions" xmlns:bld="http://www.lmonte.com/besm/bld"
    xmlns:com="http://www.lmonte.com/besm/com" xmlns:comp="http://www.lmonte.com/besm/comp"
    xmlns:d="http://www.lmonte.com/besm/d" xmlns:dtyp="http://www.lmonte.com/besm/dtyp"
    xmlns:env="http://www.lmonte.com/besm/env" xmlns:hvac="http://www.lmonte.com/besm/hvac"
    xmlns:lit="http://www.lmonte.com/besm/lit" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://www.lmonte.com/besm/CF2RMCH01bE" elementFormDefault="qualified"
    attributeFormDefault="unqualified" version="2019.1.001">
3       <xsd:import namespace="http://www.lmonte.com/besm/bld" schemaLocation="../base/ResBuilding.xsd"/>
4       <xsd:import namespace="http://www.lmonte.com/besm/com" schemaLocation="../base/ResCommon.xsd"/>
5       <xsd:import namespace="http://www.lmonte.com/besm/comp"
    schemaLocation="../base/ResCompliance.xsd"/>
6       <xsd:import namespace="http://www.lmonte.com/besm/dtyp" schemaLocation="../base/DataTypes.xsd"/>
7       <xsd:import namespace="http://www.lmonte.com/besm/env" schemaLocation="../base/ResEnvelope.xsd"/>
8       <xsd:import namespace="http://www.lmonte.com/besm/hvac" schemaLocation="../base/ResHvac.xsd"/>
9       <xsd:import namespace="http://www.lmonte.com/besm/lit" schemaLocation="../base/ResLighting.xsd"/>
10      <xsd:complexType name="CF2RMCH01bE">
11          <xsd:annotation>
12              <xsd:documentation>Space Conditioning Systems, Ducts, and Fans - MCH01b Prescriptive
    Alterations</xsd:documentation>
13          </xsd:annotation>
14          <xsd:sequence>
15              <xsd:element name="Section_A" minOccurs="1" maxOccurs="1">
16                  <xsd:annotation>
17                      <xsd:documentation source="FieldText">General Information</xsd:documentation>
18                      <xsd:documentation source="MinOccurs">This section is
    required.</xsd:documentation>
19                  </xsd:annotation>
20                  <xsd:complexType>
21                      <xsd:sequence>
22                          <xsd:element name="A01_ResidentialDwellingUnitName"
    type="com:ResidentialDwellingUnitName">
23                              <xsd:annotation>
24                                  <xsd:documentation source="FieldText">Dwelling Unit
    Name</xsd:documentation>
25                                  <xsd:documentation source="CalculationsAndRules">Reference text from
    CF1R</xsd:documentation>
26                              </xsd:annotation>
27                          </xsd:element>
28                          <xsd:element name="A02_ClimateZone" type="com:ClimateZone">
29                              <xsd:annotation>
30                                  <xsd:documentation source="FieldText">Climate Zone</xsd:documentation>
31                                  <xsd:documentation source="CalculationsAndRules">Reference text from
    CF1R</xsd:documentation>
32                              </xsd:annotation>
33                          </xsd:element>
34                          <xsd:element name="A03_DwellingUnitConditionedFloorArea"
    type="com:DwellingUnitConditionedFloorArea">
35                              <xsd:annotation>
36                                  <xsd:documentation source="FieldText">Dwelling Unit Total Conditioned
    Floor Area (ft<d:sup>2</d:sup>)</xsd:documentation>
37                                  <xsd:documentation source="CalculationsAndRules">Value is numeric:
    xxxxx  if1 CF1R parent is CF1R-PRF, then if2 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 endif2;        else if CF1R parent is CF1R-NCB-01, then if3 project scope =
    AdditionGT1000 then prompt user to enter a value equal to dwelling unit existing CFA + addition CFA,
    else if project scope = NewBuildingConstruction, then if4 ResidentialLowriseBuildingType =
    SingleFamily, then reference value from CF1R-NCB field A10, Else if ResidentialLowriseBuildingType =
    LowRiseMultiFamily, then reference value from CF1R-NCB field M02 endif4 endif3;       else if CF1R
    parent is CF1R-ADD-01, then if5 ResidentialLowriseBuildingType = SingleFamily, then reference value
    from field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ADD-01
    Section J,  else if ResidentialLowriseBuildingType = LowRiseMultiFamily, then reference value from
    field A08 from the CF1R-ALT-02 that is required for the dwelling unit according to CF1R-ADD-01 Section
    L  endif5;     else if CF1R parent is CF1R-ALT-01, then if6 ResidentialLowriseBuildingType =
    SingleFamily, then reference value from field A08 from the CF1R-ALT-02 that is required for the
©1998-201[illegible]                                                                                    Page 1
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dwelling unit according to CF1R-ALT-01 Section G else if ResidentialLowriseBuildingType =
LowRiseMultiFamily, then reference value from field A08 from the CF1R-ALT-02 that is required for the
dwelling unit according to CF1R-ALT-01 Section letter I endif6; else if CF1R parent is CF1R-ALT-02,
then reference value from CF1R-ALT-02 field A08.  endif1.    Allow user to override default and input
value; flag overridden values and report in project status notes field</xsd:documentation>
38                              </xsd:annotation>
39                          </xsd:element>
40                          <xsd:element name="A04_ResidentialDwellingUnitSpaceConditioningCount"
type="hvac:ResidentialDwellingUnitSpaceConditioningCount">
41                              <xsd:annotation>
42                                  <xsd:documentation source="FieldText">Number of Space Conditioning
Systems in this Dwelling Unit.</xsd:documentation>
43                                  <xsd:documentation source="CalculationsAndRules">integer xx; If parent
is CF1R-ALT-02 doc type, then use as default the value referenced from CF1R ALT-02 Section A (field
A10); 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>
44                              </xsd:annotation>
45                          </xsd:element>
46                          <xsd:element name="A05_ComplianceMethod" type="comp:ComplianceMethod">
47                              <xsd:annotation>
48                                  <xsd:documentation source="FieldText">Certificate of Compliance
Type</xsd:documentation>
49                                  <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>
50                              </xsd:annotation>
51                          </xsd:element>
52                          <xsd:element name="A06_HvacLoadCalculationMethod"
type="comp:HvacLoadCalculationMethod">
53                              <xsd:annotation>
54                                  <xsd:documentation source="FieldText">Method Used to Calculate HVAC
Loads</xsd:documentation>
55                                  <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>
56                              </xsd:annotation>
57                          </xsd:element>
58                          <xsd:choice maxOccurs="1">
59                              <xsd:element name="A07_DesignSensibleCoolingLoad"
type="hvac:DesignSensibleCoolingLoad">
60                                  <xsd:annotation>
61                                      <xsd:documentation source="FieldText">Calculated Dwelling Unit
Sensible Cooling Load (Btu/h)</xsd:documentation>
62                                      <xsd:documentation source="CalculationsAndRules">If
A06_HvacLoadCalculationMethod == NotApplicableEquipmentChangeout Then result = NotApplicable stored in
the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
63                                  </xsd:annotation>
64                              </xsd:element>
65                              <xsd:element name="A07_NotApplicableMessage"
type="comp:NotApplicableMessage">
66                                  <xsd:annotation>
67                                      <xsd:documentation source="FieldText">Calculated Dwelling Unit
Sensible Cooling Load (Btu/h)</xsd:documentation>
68                                      <xsd:documentation source="CalculationsAndRules">If
A06_HvacLoadCalculationMethod == NotApplicableEquipmentChangeout Then result = NotApplicable stored in
the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
69                                  </xsd:annotation>
70                              </xsd:element>
71                          </xsd:choice>
72                          <xsd:choice maxOccurs="1">
73                              <xsd:element name="A08_DwellingUnitDesignHeatingLoad"
type="hvac:DwellingUnitDesignHeatingLoad">
```



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                                <xsd:annotation>
                                    <xsd:documentation source="FieldText">Calculated Dwelling Unit Heating Load (Btu/h)</xsd:documentation>
                                    <xsd:documentation source="CalculationsAndRules">If A06_HvacLoadCalculationMethod == NotApplicableEquipmentChangeout Then result = NotApplicable stored in the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
                                </xsd:annotation>
                            </xsd:element>
                            <xsd:element name="A08_NotApplicableMessage" type="comp:NotApplicableMessage">
                                <xsd:annotation>
                                    <xsd:documentation source="FieldText">Calculated Dwelling Unit Heating Load (Btu/h)</xsd:documentation>
                                    <xsd:documentation source="CalculationsAndRules">If A06_HvacLoadCalculationMethod == NotApplicableEquipmentChangeout Then result = NotApplicable stored in the  NotAppplicableMessage Else User entry integer xxxxx</xsd:documentation>
                                </xsd:annotation>
                            </xsd:element>
                        </xsd:choice>
                        <xsd:element name="A09_BedroomCount" type="com:BedroomCount">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Dwelling Unit Number of Bedrooms</xsd:documentation>
                                <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 valueconstrained to be GTE default value from CF1R-PRF,  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>
                            </xsd:annotation>
                        </xsd:element>
                        <xsd:element name="A09After" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Variant MCH-01b</xsd:documentation>
                                <xsd:documentation source="AdditionalRequirements">MCH-01b - Space Conditioning Systems Ducts and Fans - Prescriptive Alterations</xsd:documentation>
                                <xsd:documentation source="CalculationsAndRules">Calculated field: If1 ComplianceMethod  in A05 = Performance, then if2 CF1R-PRF project scope = Addition and/or Alteration Or Newly Constructed (Addition Alone) then display doc variation MCH-01d ;   elseif  CF1R-PRF project scope = Newly Constructed display doc variation  MCH-01a endif2;     ElseIf ComplianceMethod = PrescriptiveAlterations, Or  PrescriptiveAddiitions, then display doc variation MCH-01b;  ElseIf ComplianceMethod  equals PrescriptiveNewConstruction  then display doc variation MCH-01c endif1</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="Section_B" minOccurs="1">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">Space Conditioning (SC) System Information</xsd:documentation>
                    <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>
                    <xsd:documentation source="MinOccurs">This section is required.</xsd:documentation>
                </xsd:annotation>
                <xsd:complexType>
                    <xsd:sequence>
                        <xsd:element name="TableSystemInformation">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText"/>
                            </xsd:annotation>
                            <xsd:complexType>
```

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                                <xsd:sequence>
                                    <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
                                        <xsd:complexType>
                                            <xsd:sequence>
                                                <xsd:element
    name="B01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
    System ID/ Name from CF1R</xsd:documentation>
                                                        <xsd:documentation
    source="CalculationsAndRules">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>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element
    name="B02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
    System Description of Area Served</xsd:documentation>
                                                        <xsd:documentation
    source="CalculationsAndRules">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.  Require each entry to be unique in this dwelling unit i.e. unique
    within the scope of this instance of the MCH-01</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element
    name="B03_ResidentialHvacSystemConditionedArea" type="hvac:ResidentialHvacSystemConditionedArea">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">CFA
    served by this SC System (ft<d:sup>2</d:sup>)</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</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="B04_DuctedSystem"
    type="comp:DuctedSystem">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Is the
    SC system a ducted 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="B05_IncludesComponentWithRefrigerant" type="comp:IncludesComponentWithRefrigerant">
                                                    <xsd:annotation>
                                                        <xsd:documentation
    source="FieldText">Installing a refrigerant containing component?</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="B06_InstallingNewComponents"
    type="comp:InstallingNewComponents">
                                                    <xsd:annotation>
                                                        <xsd:documentation
    source="FieldText">Installing new SC system components?</xsd:documentation>
                                                        <xsd:documentation
```

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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>
153                                                   </xsd:annotation>
154                                                </xsd:element>
155                                                <xsd:element
      name="B07_Installing40PlusLinearFeetDucts" type="comp:Installing40PlusLinearFeetDucts">
156                                                   <xsd:annotation>
157                                                      <xsd:documentation
      source="FieldText">Installing more than 40 feet of ducts?</xsd:documentation>
158                                                      <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>
159                                                   </xsd:annotation>
160                                                </xsd:element>
161                                                <xsd:element
      name="B08_DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced"
      type="comp:DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced">
162                                                   <xsd:annotation>
163                                                      <xsd:documentation
      source="FieldText">Installing entirely new duct system?</xsd:documentation>
164                                                      <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>
165                                                   </xsd:annotation>
166                                                </xsd:element>
167                                                <xsd:element name="B09_AllNewOrReplacedHvacSystem"
      type="comp:AllNewOrReplacedHvacSystem">
168                                                   <xsd:annotation>
169                                                      <xsd:documentation
      source="FieldText">Installing entirely new SC system?</xsd:documentation>
170                                                      <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>
171                                                   </xsd:annotation>
172                                                </xsd:element>
173                                                <xsd:element name="B10_ResidentialHvacAlterationType"
      type="hvac:ResidentialHvacAlterationType">
174                                                   <xsd:annotation>
175                                                      <xsd:documentation
      source="FieldText">Alteration Type</xsd:documentation>
176                                                      <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>
177                                                   </xsd:annotation>
178                                                </xsd:element>
179                                             </xsd:sequence>
180                                          </xsd:complexType>
181                                       </xsd:element>
182                                    </xsd:sequence>
183                                 </xsd:complexType>
184                              </xsd:element>
185                              <xsd:element name="B10a_SectionComments" type="comp:SectionComments"
```

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      minOccurs="0">
186                           <xsd:annotation>
187                               <xsd:documentation source="FieldText">Notes</xsd:documentation>
188                           </xsd:annotation>
189                       </xsd:element>
190                   </xsd:sequence>
191               </xsd:complexType>
192           </xsd:element>
193           <xsd:element name="Section_C" minOccurs="1">
194               <xsd:annotation>
195                   <xsd:documentation source="FieldText">Space Conditioning (SC) System Alterations
      Compliance Information</xsd:documentation>
196                   <xsd:documentation source="CalculationsAndRules">Require one row of data in this
      table for each of the SC Systems listed in Section B for which B10_ResidentialHvacAlterationType !=
      NoAlterationsPerformed</xsd:documentation>
197                   <xsd:documentation source="MinOccurs">This section is
      required.</xsd:documentation>
198               </xsd:annotation>
199               <xsd:complexType>
200                   <xsd:sequence>
201                       <xsd:element name="TableAlterations">
202                           <xsd:annotation>
203                               <xsd:documentation source="FieldText"/>
204                           </xsd:annotation>
205                           <xsd:complexType>
206                               <xsd:sequence>
207                                   <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
208                                       <xsd:complexType>
209                                           <xsd:sequence>
210                                               <xsd:element
      name="C01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
211                                                   <xsd:annotation>
212                                                       <xsd:documentation source="FieldText">SC
      System ID/ Name from CF1R</xsd:documentation>
213                                                       <xsd:documentation
      source="CalculationsAndRules">Reference value from
      B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
214                                                   </xsd:annotation>
215                                               </xsd:element>
216                                               <xsd:element
      name="C02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
217                                                   <xsd:annotation>
218                                                       <xsd:documentation source="FieldText">SC
      System Description of Area Served</xsd:documentation>
219                                                       <xsd:documentation
      source="CalculationsAndRules">Reference value from
      B02_ResidentialHvacSystemAreaServed</xsd:documentation>
220                                                   </xsd:annotation>
221                                               </xsd:element>
222                                               <xsd:element name="C03_ResidentialHeatingSystemType"
      type="hvac:ResidentialHeatingSystemType">
223                                                   <xsd:annotation>
224                                                       <xsd:documentation source="FieldText">Heating
      System Type</xsd:documentation>
225                                                       <xsd:documentation
      source="CalculationsAndRules">Reference value from CF1R as default; allow user to override the default
      and pick one from list: CentralGasFurnace, CentralSplitHP, CentralPackagedHP, CentralLargePackagedHP,
      DuctlessSplitHP (display term Ductless mini-split HP), RoomHP, Boiler, Hydronic, CombinedHydronic,
      HydronicForcedAir, CombinedHydronicForcedAir, HydronicHP,  HydronicHP_ForcedAir, GasPackagedFurnace,
      GasWallFurnace , GasSpaceHeater, Electric, NonAirSourceHP, WoodHeat, SmallDuctHighVelocityHP,
      DuctedMultiSplitHP, DuctlessMultiSplitHP, DuctedDuctlessMultiSplitHP, DuctlessVRF_HP, WoodHeat and
      NoHeating.  If result == NoHeating then check: there must be at least one heating system entered in
      this section C04 to comply, else flag noncompliant condition (no heating installed) and do not allow
      registration to continue.  Flag non-default values and report in project status notes field; a
      revised CF1R may be required</xsd:documentation>
226                                                   </xsd:annotation>
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                                                </xsd:element>
                                                <xsd:sequence maxOccurs="unbounded">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Altered Heating Component</xsd:documentation>
                                                        <xsd:documentation source="CalculationsAndRules">Reference value from CF1R as default; allow user to override the default and pick as many as are applicable from list: GasFurnaceAHU, FancoilAHU, OutdoorCondensingUnit, IndoorCoil, Boiler, TXV_EXV, Compressor, RefrigerantLineset, NoHeatingComponentsAltered.  Flag non-default values and report in project status notes field; a revised CF1R may be required.</xsd:documentation>
                                                    </xsd:annotation>
                                                    <xsd:element name="C04_ResidentialHvacHeatingComponentType" type="hvac:ResidentialHvacHeatingComponentType"/>
                                                </xsd:sequence>
                                                <xsd:choice maxOccurs="1">
                                                    <xsd:element name="C05_EfficiencyType">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Heating Efficiency Type</xsd:documentation>
                                                            <xsd:documentation source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType == NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir, CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicable stored in NotApplicableMessage; Else reference value from CF1R as default but 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</xsd:documentation>
                                                        </xsd:annotation>
                                                        <xsd:simpleType>
                                                            <xsd:restriction base="hvac:EfficiencyType">
                                                                <xsd:enumeration value="AFUE"/>
                                                                <xsd:enumeration value="COP"/>
                                                                <xsd:enumeration value="HSPF"/>
                                                            </xsd:restriction>
                                                        </xsd:simpleType>
                                                    </xsd:element>
                                                    <xsd:element name="C05_NotApplicableMessage" type="comp:NotApplicableMessage">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Heating Efficiency Type</xsd:documentation>
                                                            <xsd:documentation source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType == NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir, CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicable stored in NotApplicableMessage; Else reference value from CF1R as default but 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</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                </xsd:choice>
                                                <xsd:choice maxOccurs="1">
                                                    <xsd:element name="C06_EfficiencyMinimumValueAFUE" type="hvac:EfficiencyMinimumValueAFUE">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Heating Minimum Efficiency Value</xsd:documentation>
                                                            <xsd:documentation source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType == NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir, CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicable stored in NotApplicableMessage; Else  reference value from CF1R as default; but allow user to override the
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default to enter numeric value xx.x;  default minimum value for AFUE= 0.80 display term 80%; or
default minimum value for HSPF=8.0; Flag non-default values and report in project status notes field a
revised CF1R may be required.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="C06_EfficiencyMinimumValueCOP"
type="hvac:EfficiencyMinimumValueCOP">
                                                    <xsd:annotation>
                                                        <xsd:documentation
source="FieldText">Heating Minimum Efficiency Value</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType ==
NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If
C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir,
CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicablestored in
NotApplicableMessage; Else  reference value from CF1R as default; but allow user to override the
default to enter numeric value xx.x;  default minimum value for AFUE= 0.80 display term 80%; or
default minimum value for HSPF=8.0; Flag non-default values and report in project status notes field a
revised CF1R may be required.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="C06_EfficiencyMinimumValueHSPF"
type="hvac:EfficiencyMinimumValueHSPF">
                                                    <xsd:annotation>
                                                        <xsd:documentation
source="FieldText">Heating Minimum Efficiency Value</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType ==
NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If
C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir,
CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicable stored in
NotApplicableMessage; Else  reference value from CF1R as default; but allow user to override the
default to enter numeric value xx.x;  default minimum value for AFUE= 0.80 display term 80%; or
default minimum value for HSPF=8.0; Flag non-default values and report in project status notes field a
revised CF1R may be required.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="C06_NotApplicableMessage"
type="comp:NotApplicableMessage">
                                                    <xsd:annotation>
                                                        <xsd:documentation
source="FieldText">Heating Minimum Efficiency Value</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">If C04_ResidentialHvacHeatiingComponentType ==
NoHeatingComponentsAltered result = NotApplicable stored in NotApplicablemessage; Else If
C03_ResidentialHeatingSystemType == Hydronic, CombinedHydronic, HydronicForcedAir,
CombinedHydronicForcedAir, HydronicHP,  Or HydronicHP_ForcedAir  result = NotApplicable stored in
NotApplicableMessage; Else  Else reference value from CF1R as default; but allow user to override the
default to enter numeric value xx.x;  default minimum value for AFUE= 0.80 display term 80%; or
default minimum value for HSPF=8.0; Flag non-default values and report in project status notes field a
revised CF1R may be required.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                            </xsd:choice>
                                            <xsd:element name="C07_ResidentialCoolingSystemType"
type="hvac:ResidentialCoolingSystemType">
                                                <xsd:annotation>
                                                    <xsd:documentation source="FieldText">Cooling
System Type</xsd:documentation>
                                                    <xsd:documentation
source="CalculationsAndRules">Reference value from CF1R as default; allow user to override the default
and pick one from list: CentralLargePackagedAC, CentralLargePackagedHP, CentralPackagedAC,
CentralPackagedHP, CentralSplitAC, CentralSplitHP, DuctedMultiSplitAC, DuctedMultiSplitHP,
DuctlessMultiSplitAC, DuctlessMultiSplitHP, DuctedDuctlessMultiSplitAC, DuctedDuctlessMultiSplitHP,
DuctlessSplitAC (display term Ductless mini-split AC) , DuctlessSplitHP (display term Ductless
mini-split HP), DuctlessVRF_AC, DuctlessVRF_HP, EvaporativeDirect, EvaporativeIndirect,
```

```
      EvaporativeIndirectDirect, EvaporativelyCooledCondenser, GasAbsorptionAC, GroundSourceHeatPump,
      Hydronic, HydronicHP, HydronicHP_ForcedAir, IceStorageAC, NoCooling, NonAirCooledAC, NonAirSourceHP,
      RoomAC, RoomHP, SmallDuctHighVelocityHP, SmallDuctHighVelocityAC.  Flag non-default values and report
      in project status notes field; a revised CF1R may be required</xsd:documentation>
286                                                 </xsd:annotation>
287                                             </xsd:element>
288                                             <xsd:sequence maxOccurs="unbounded">
289                                                 <xsd:annotation>
290                                                     <xsd:documentation source="FieldText">Altered
      Cooling Component</xsd:documentation>
291                                                     <xsd:documentation
      source="CalculationsAndRules">Reference value from CF1R as default; allow user to override the default
      and pick as many as are applicable from list: OutdoorCondensingUnit, FancoilAHU,  IndoorCoil, TXV_EXV,
      Compressor, RefrigerantLineset, NoCoolingComponentsAltered. Flag non-default values and report in
      project status notes field; a revised CF1R may be required</xsd:documentation>
292                                                 </xsd:annotation>
293                                                 <xsd:element
      name="C08_ResidentialHvacCoolingComponentType" type="hvac:ResidentialHvacCoolingComponentType"/>
294                                             </xsd:sequence>
295                                             <xsd:choice maxOccurs="1">
296                                                 <xsd:element name="C09_EfficiencyType">
297                                                     <xsd:annotation>
298                                                         <xsd:documentation
      source="FieldText">Cooling Efficiency Type</xsd:documentation>
299                                                         <xsd:documentation
      source="CalculationsAndRules">Reference value from CF1R as default; If
      C08_ResidentialHvacCoolingComponentType == NoCoolingComponentsAltered, then result is NotApplicable
      stored in NotApplicableMessage, Else allow user to override the default by picking from list:  SEER,
      EER.  Flag non-default values and report in project status notes field; a revised CF1R may be
      required</xsd:documentation>
300                                                     </xsd:annotation>
301                                                     <xsd:simpleType>
302                                                         <xsd:restriction
      base="hvac:EfficiencyType">
303                                                             <xsd:enumeration value="EER"/>
304                                                             <xsd:enumeration value="SEER"/>
305                                                         </xsd:restriction>
306                                                     </xsd:simpleType>
307                                                 </xsd:element>
308                                                 <xsd:element name="C09_NotApplicableMessage"
      type="comp:NotApplicableMessage">
309                                                     <xsd:annotation>
310                                                         <xsd:documentation
      source="FieldText">Cooling Efficiency Type</xsd:documentation>
311                                                         <xsd:documentation
      source="CalculationsAndRules">Reference value from CF1R as default; If
      C08_ResidentialHvacCoolingComponentType == NoCoolingComponentsAltered, then result  is
      NotApplicablestored in NotApplicableMessage, Else allow user to override the default by picking from
      list:  SEER, EER.  Flag non-default values and report in project status notes field; a revised CF1R
      may be required</xsd:documentation>
312                                                     </xsd:annotation>
313                                                 </xsd:element>
314                                             </xsd:choice>
315                                             <xsd:choice maxOccurs="1">
316                                                 <xsd:element name="C10_EfficiencyMinimumValueSEER"
      type="hvac:EfficiencyMinimumValueSEER">
317                                                     <xsd:annotation>
318                                                         <xsd:documentation
      source="FieldText">Cooling Minimum Efficiency Value</xsd:documentation>
319                                                         <xsd:documentation
      source="CalculationsAndRules">Reference value from CF1R as default; if
      C08_ResidentialHvacCoolingComponentType == NoCoolingComponentsAltered, then result  is NotApplicable
      stored in NotApplicableMessage, 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</xsd:documentation>
320                                                     </xsd:annotation>
```



```
321                                                 </xsd:element>
322                                                 <xsd:element name="C10_EfficiencyMinimumValueEER"
    type="hvac:EfficiencyMinimumValueEER">
323                                                     <xsd:annotation>
324                                                         <xsd:documentation
    source="FieldText">Cooling Minimum Efficiency Value</xsd:documentation>
325                                                         <xsd:documentation
    source="CalculationsAndRules">Reference value from CF1R as default; if
    C08_ResidentialHvacCoolingComponentType == NoCoolingComponentsAltered, then result  is NotApplicable
    stored in NotApplicableMessage, 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</xsd:documentation>
326                                                     </xsd:annotation>
327                                                 </xsd:element>
328                                                 <xsd:element name="C10_NotApplicableMessage"
    type="comp:NotApplicableMessage">
329                                                     <xsd:annotation>
330                                                         <xsd:documentation
    source="FieldText">Cooling Minimum Efficiency Value</xsd:documentation>
331                                                         <xsd:documentation
    source="CalculationsAndRules">Reference value from CF1R as default; if
    C08_ResidentialHvacCoolingComponentType == NoCoolingComponentsAltered, then result  is NotApplicable
    stored in NotApplicableMessage, 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</xsd:documentation>
332                                                     </xsd:annotation>
333                                                 </xsd:element>
334                                             </xsd:choice>
335                                             <xsd:choice maxOccurs="1">
336                                                 <xsd:element name="C11_ThermostatType">
337                                                     <xsd:annotation>
338                                                         <xsd:documentation
    source="FieldText">Required Thermostat Type</xsd:documentation>
339                                                         <xsd:documentation
    source="CalculationsAndRules">If B10_ResidentialHvacAlterationType == DuctSystemExistingExtended Then
    result = NotApplicable stored in NotApplicableMessage. Else result =  SetbackThermostat; Allow user to
    override the default and select one from list. Choices for ThermostatType: SetbackThermostat ,
    OccupantControlledSmartThermostat,  EnergyManagementSystem</xsd:documentation>
340                                                     </xsd:annotation>
341                                                     <xsd:simpleType>
342                                                         <xsd:restriction
    base="hvac:ThermostatType">
343                                                             <xsd:enumeration
    value="EnergyManagementSystem"/>
344                                                             <xsd:enumeration
    value="OccupantControlledSmartThermostat"/>
345                                                             <xsd:enumeration
    value="SetbackThermostat"/>
346                                                         </xsd:restriction>
347                                                     </xsd:simpleType>
348                                                 </xsd:element>
349                                                 <xsd:element name="C11_NotApplicableMessage"
    type="comp:NotApplicableMessage">
350                                                     <xsd:annotation>
351                                                         <xsd:documentation
    source="FieldText">Required Thermostat Type</xsd:documentation>
352                                                         <xsd:documentation
    source="CalculationsAndRules">If B10_ResidentialHvacAlterationType == DuctSystemExistingExtended Then
    result = NotApplicable stored in the C11_NotApplicableMessage. Else result =  SetbackThermostat stored
    in C11_ThermostatType</xsd:documentation>
353                                                     </xsd:annotation>
354                                                 </xsd:element>
355                                             </xsd:choice>
356                                             <xsd:choice maxOccurs="1">
357                                                 <xsd:element name="C12_IndoorUnitsCount"
    type="hvac:IndoorUnitsCount">
```



```
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Number of Indoor Units Connected to the System's Outdoor Unit</xsd:documentation>
                                                        <xsd:documentation source="CalculationsAndRules">If C03 Or C07 == RoomHP, RoomAC, GasWallFurnace , GasSpaceHeater, Electric, WoodHeat, GasPackagedFurnace, CentralPackagedAC, CentralPackagedHP, CentralLargePackagedAC, CentralLargePackagedHP, EvaporativeDirect, EvaporativeIndirect, EvaporativeIndirectDirect, EvaporativelyCooledCondenser result = NotApplicable stored in NotApplicableMessage; Else If C14_IsVentilationSystemCFI == true result = 1; Else default result = 1;  Allow user to override and enter either 1 or NotApplicable stored in NotApplicableMessage.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="C12_NotApplicableMessage" type="comp:NotApplicableMessage">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Number of Indoor Units Connected to the System's Outdoor Unit</xsd:documentation>
                                                        <xsd:documentation source="CalculationsAndRules">If C03 Or C07 == RoomHP, GasWallFurnace , GasSpaceHeater, Electric, WoodHeat, GasPackagedFurnace, CentralPackagedAC, CentralPackagedHP, CentralLargePackagedAC, CentralLargePackagedHP, EvaporativeDirect, EvaporativeIndirect, EvaporativeIndirectDirect, EvaporativelyCooledCondenser result = NotApplicable stored in NotApplicableMessage; Else If C14_IsVentilationSystemCFI == true result = 1; Else default result = 1;  Allow user to override and enter either 1 or NotApplicable stored in NotApplicableMessage.</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                            </xsd:choice>
                                            <xsd:choice maxOccurs="1">
                                                <xsd:element name="C13_DuctedIndoorUnitsCount" type="hvac:DuctedIndoorUnitsCount">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Number of Ducted Indoor Units Connected to the System's Outdoor Unit</xsd:documentation>
                                                        <xsd:documentation source="CalculationsAndRules">If B04_DuctedSystem == false, then result = NotApplicable stored in NotApplicableMessage with display text: N/A   Else  default value = 1; allow user to overwrite the default to enter an integer value GT 1</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="C13_NotApplicableMessage" type="comp:NotApplicableMessage">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Number of Ducted Indoor Units Connected to the System's Outdoor Unit</xsd:documentation>
                                                        <xsd:documentation source="CalculationsAndRules">If B04_DuctedSystem == false, then result = NotApplicable stored in NotApplicableMessage with display text: N/A   Else  default value = 1; allow user to overwrite the default to enter an integer value GT 1</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                            </xsd:choice>
                                            <xsd:element name="C14_IsVentilationSystemCFI" type="comp:IsVentilationSystemCFI">
                                                <xsd:annotation>
                                                    <xsd:documentation source="FieldText">Central Fan Integrated (CFI) Ventilation System Status</xsd:documentation>
                                                    <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>
                                                </xsd:annotation>
                                            </xsd:element>
                                        </xsd:sequence>
                                    </xsd:complexType>
                                </xsd:element>
```

```
                                </xsd:sequence>
                            </xsd:complexType>
                        </xsd:element>
                        <xsd:element name="C14a_SectionComments" type="comp:SectionComments"
minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Notes:</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="Section_D" minOccurs="0" maxOccurs="1">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">Installed Heating Equipment
Information</xsd:documentation>
                    <xsd:documentation source="CalculationsAndRules">This Section is applicable only
at least one SC System has a value for C04_ResidentialHvacHeatiingComponentType !=
NoHeatingComponentsAltered.  If applicable, require one row of data in this table for each of the SC
Systems listed in Section C  with C04_ResidentialHvacHeatiingComponentType !=
NoHeatingComponentsAltered.</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="TableHeating">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText"/>
                            </xsd:annotation>
                            <xsd:complexType>
                                <xsd:sequence>
                                    <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
                                        <xsd:complexType>
                                            <xsd:sequence>
                                                <xsd:element
name="D01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
System ID/ Name from CF1R</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">Referencevalue from
B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element
name="D02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
System Description of Area Served</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">Reference value from
B02_ResidentialHvacSystemAreaServed</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:choice maxOccurs="1">
                                                    <xsd:element name="D03_EfficiencyType">
                                                        <xsd:annotation>
                                                            <xsd:documentation
source="FieldText">Heating Efficiency Type</xsd:documentation>
                                                            <xsd:documentation
source="CalculationsAndRules">Reference to either Heating EfficiencyType
value in C05_EfficiencyType or C05_NotApplicableMessage</xsd:documentation>
                                                        </xsd:annotation>
                                                        <xsd:simpleType>
```

```
441                                                     <xsd:restriction
base="hvac:EfficiencyType">
442                                                         <xsd:enumeration value="AFUE"/>
443                                                         <xsd:enumeration value="COP"/>
444                                                         <xsd:enumeration value="HSPF"/>
445                                                     </xsd:restriction>
446                                                 </xsd:simpleType>
447                                             </xsd:element>
448                                             <xsd:element name="D03_NotApplicableMessage"
type="comp:NotApplicableMessage">
449                                                 <xsd:annotation>
450                                                     <xsd:documentation
source="FieldText">Heating Efficiency Type</xsd:documentation>
451                                                     <xsd:documentation
source="CalculationsAndRules">Reference to either Heating EfficiencyType
452 value in C05_EfficiencyType or C05_NotApplicableMessage</xsd:documentation>
453                                                 </xsd:annotation>
454                                             </xsd:element>
455                                         </xsd:choice>
456                                         <xsd:choice maxOccurs="1">
457                                             <xsd:element
name="D04_EfficiencyInstalledValueAFUE" type="hvac:EfficiencyInstalledValueAFUE">
458                                                 <xsd:annotation>
459                                                     <xsd:documentation
source="FieldText">Heating Efficiency Value</xsd:documentation>
460                                                     <xsd:documentation
source="CalculationsAndRules">If C06_NotApplicableMessage == NotApplicable result = NotApplicable
stored in NotApplicableMessage Else user input numeric value; If  result GTE
C06_EfficiencyMinimumValueAFUE, result complies, Else flag it as a non-compliant value and do not
allow this document to be registered.</xsd:documentation>
461                                                 </xsd:annotation>
462                                             </xsd:element>
463                                             <xsd:element
name="D04_EfficiencyInstalledValueCOP" type="hvac:EfficiencyInstalledValueCOP">
464                                                 <xsd:annotation>
465                                                     <xsd:documentation
source="FieldText">Heating Efficiency Value</xsd:documentation>
466                                                     <xsd:documentation
source="CalculationsAndRules">If C06_NotApplicableMessage == NotApplicable result = NotApplicable
stored in NotApplicableMessage Else user input numeric value; If  result GTE
C06_EfficiencyMinimumValueCOP, result complies, Else flag it as a non-compliant value and do not allow
this document to be registered.</xsd:documentation>
467                                                 </xsd:annotation>
468                                             </xsd:element>
469                                             <xsd:element
name="D04_EfficiencyInstalledValueHSPF" type="hvac:EfficiencyInstalledValueHSPF">
470                                                 <xsd:annotation>
471                                                     <xsd:documentation
source="FieldText">Heating Efficiency Value</xsd:documentation>
472                                                     <xsd:documentation
source="CalculationsAndRules">If C06_NotApplicableMessage == NotApplicable result = NotApplicable
stored in NotApplicableMessage Else user input numeric value; If  result GTE
C06_EfficiencyMinimumValueHSPF, result complies, Else flag it as a non-compliant value and do not
allow this document to be registered.</xsd:documentation>
473                                                 </xsd:annotation>
474                                             </xsd:element>
475                                             <xsd:element name="D04_NotApplicableMessage"
type="comp:NotApplicableMessage">
476                                                 <xsd:annotation>
477                                                     <xsd:documentation
source="FieldText">Heating Efficiency Value</xsd:documentation>
478                                                     <xsd:documentation
source="CalculationsAndRules">If C06_NotApplicableMessage == NotApplicable result = NotApplicable
stored in NotApplicableMessage Else user input numeric value;</xsd:documentation>
479                                                 </xsd:annotation>
480                                             </xsd:element>
```



```
                                                </xsd:choice>
                                                <xsd:element name="D05_HeatingUnitManufacturer"
type="comp:HeatingUnitManufacturer">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Heating
Unit Manufacturer</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="D06_HeatingUnitModelNumber"
type="comp:HeatingUnitModelNumber">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Heating
Unit Model Number</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="D07_HeatingUnitSerialNumber"
type="comp:HeatingUnitSerialNumber">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Heating
Unit Serial Number</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="D08_HeatingEquipmentRatedCapacity"
type="hvac:HeatingEquipmentRatedCapacity">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Rated
Heating Capacity, Output (Btu/h)</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                            </xsd:sequence>
                                        </xsd:complexType>
                                    </xsd:element>
                                </xsd:sequence>
                            </xsd:complexType>
                        </xsd:element>
                        <xsd:element name="D08a_SectionComments" type="comp:SectionComments"
minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Notes:</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="Section_E" minOccurs="0">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">Installed Cooling Equipment
Information</xsd:documentation>
                    <xsd:documentation source="CalculationsAndRules">This Section is applicable only
if  one or more systems in section C has  C07_ResidentialCoolingSystemType
!= NoCooling.   Require one row of data in this table for each of the SC Systems listed in Section C
that has a C07_ResidentialCoolingSystemType  != NoCooling, Or C08_ResidentialHvacCoolingComponentType
!= NoCoolingComponentsAltered</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="TableCooling">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText"/>
                            </xsd:annotation>
                            <xsd:complexType>
                                <xsd:sequence>
                                    <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
```

```
532                                         <xsd:complexType>
533                                             <xsd:sequence>
534                                                 <xsd:element
    name="E01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
535                                                     <xsd:annotation>
536                                                         <xsd:documentation source="FieldText">SC
    System ID/ Name from CF1R</xsd:documentation>
537                                                         <xsd:documentation
    source="CalculationsAndRules">Referencevalue from
    B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
538                                                     </xsd:annotation>
539                                                 </xsd:element>
540                                                 <xsd:element
    name="E02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
541                                                     <xsd:annotation>
542                                                         <xsd:documentation source="FieldText">SC
    System Description of Area Served</xsd:documentation>
543                                                         <xsd:documentation
    source="CalculationsAndRules">Reference value from
    B02_ResidentialHvacSystemAreaServed</xsd:documentation>
544                                                     </xsd:annotation>
545                                                 </xsd:element>
546                                                 <xsd:element name="E03_EfficiencyType">
547                                                     <xsd:annotation>
548                                                         <xsd:documentation source="FieldText">Cooling
    Efficiency Type</xsd:documentation>
549                                                         <xsd:documentation
    source="CalculationsAndRules">Reference to Cooling C09_EfficiencyType in section C</xsd:documentation>
550                                                     </xsd:annotation>
551                                                     <xsd:simpleType>
552                                                         <xsd:restriction base="hvac:EfficiencyType">
553                                                             <xsd:enumeration value="EER"/>
554                                                             <xsd:enumeration value="SEER"/>
555                                                         </xsd:restriction>
556                                                     </xsd:simpleType>
557                                                 </xsd:element>
558                                                 <xsd:choice maxOccurs="1">
559                                                     <xsd:element
    name="E04_EfficiencyInstalledValueSEER" type="hvac:EfficiencyInstalledValueSEER">
560                                                         <xsd:annotation>
561                                                             <xsd:documentation
    source="FieldText">Cooling Efficiency Value</xsd:documentation>
562                                                             <xsd:documentation
    source="CalculationsAndRules">User input;  Check that result  is GTE C10_EfficiencyMinimumValue in
    section C; Else  flag as a non-compliant value and do not allow this document to be
    registered.</xsd:documentation>
563                                                         </xsd:annotation>
564                                                     </xsd:element>
565                                                     <xsd:element
    name="E04_EfficiencyInstalledValueEER" type="hvac:EfficiencyInstalledValueEER">
566                                                         <xsd:annotation>
567                                                             <xsd:documentation
    source="FieldText">Cooling Efficiency Value</xsd:documentation>
568                                                             <xsd:documentation
    source="CalculationsAndRules">User input;  Check that result  is GTE C10_EfficiencyMinimumValue in
    section C; Else  flag as a non-compliant value and do not allow this document to be
    registered.</xsd:documentation>
569                                                         </xsd:annotation>
570                                                     </xsd:element>
571                                                 </xsd:choice>
572                                                 <xsd:choice maxOccurs="1">
573                                                     <xsd:element name="E05_CondenserManufacturer"
    type="comp:CondenserManufacturer">
574                                                         <xsd:annotation>
575                                                             <xsd:documentation
    source="FieldText">Condenser or Package Unit Manufacturer</xsd:documentation>
```

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576                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
577                                                 </xsd:annotation>
578                                             </xsd:element>
579                                             <xsd:element name="E05_PackageUnitManufacturer"
type="comp:PackageUnitManufacturer">
580                                                 <xsd:annotation>
581                                                     <xsd:documentation
source="FieldText">Condenser or Package Unit Manufacturer</xsd:documentation>
582                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
583                                                 </xsd:annotation>
584                                             </xsd:element>
585                                         </xsd:choice>
586                                         <xsd:choice maxOccurs="1">
587                                             <xsd:element name="E06_CondenserModelNumber"
type="comp:CondenserModelNumber">
588                                                 <xsd:annotation>
589                                                     <xsd:documentation
source="FieldText">Condenser or Package Unit Model Number</xsd:documentation>
590                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
591                                                 </xsd:annotation>
592                                             </xsd:element>
593                                             <xsd:element name="E06_PackageUnitModelNumber"
type="comp:PackageUnitModelNumber">
594                                                 <xsd:annotation>
595                                                     <xsd:documentation
source="FieldText">Condenser or Package Unit Model Number</xsd:documentation>
596                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
597                                                 </xsd:annotation>
598                                             </xsd:element>
599                                         </xsd:choice>
600                                         <xsd:choice maxOccurs="1">
601                                             <xsd:element name="E07_CondenserSerialNumber"
type="comp:CondenserSerialNumber">
602                                                 <xsd:annotation>
603                                                     <xsd:documentation
source="FieldText">Condenser or Package Unit Serial Number</xsd:documentation>
604                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
605                                                 </xsd:annotation>
606                                             </xsd:element>
607                                             <xsd:element name="E07_PackageUnitSerialNumber"
type="comp:PackageUnitSerialNumber">
608                                                 <xsd:annotation>
609                                                     <xsd:documentation
source="FieldText">Condenser or Package Unit Serial Number</xsd:documentation>
610                                                     <xsd:documentation
source="CalculationsAndRules">User input alphanumeric value</xsd:documentation>
611                                                 </xsd:annotation>
612                                             </xsd:element>
613                                         </xsd:choice>
614                                         <xsd:element name="E08_CoolingEquipmentRatedCapacity"
type="hvac:CoolingEquipmentRatedCapacity">
615                                             <xsd:annotation>
616                                                 <xsd:documentation source="FieldText">System
Cooling Capacity at Design Conditions (Btu/h)</xsd:documentation>
617                                                 <xsd:documentation
source="CalculationsAndRules">User input numeric xxxxxx</xsd:documentation>
618                                             </xsd:annotation>
619                                         </xsd:element>
620                                         <xsd:element
name="E09_CondenserNominalCoolingCapacity" type="hvac:CondenserNominalCoolingCapacity">
621                                             <xsd:annotation>
```

```
622                                                     <xsd:documentation
source="FieldText">Condenser Nominal Capacity (ton)</xsd:documentation>
623                                                     <xsd:documentation
source="CalculationsAndRules">User input numeric x.x</xsd:documentation>
624                                                 </xsd:annotation>
625                                             </xsd:element>
626                                         </xsd:sequence>
627                                     </xsd:complexType>
628                                 </xsd:element>
629                             </xsd:sequence>
630                         </xsd:complexType>
631                     </xsd:element>
632                     <xsd:element name="E09a_SectionComments" type="comp:SectionComments"
minOccurs="0">
633                         <xsd:annotation>
634                             <xsd:documentation source="FieldText">Notes:</xsd:documentation>
635                         </xsd:annotation>
636                     </xsd:element>
637                 </xsd:sequence>
638             </xsd:complexType>
639         </xsd:element>
640         <xsd:element name="Section_F" minOccurs="0">
641             <xsd:annotation>
642                 <xsd:documentation source="FieldText">Altered Space Conditioning System Duct
Information (
643                   <d:lt/> 75% of duct system is altered; or duct system is not
altered)</xsd:documentation>
644                 <xsd:documentation source="CalculationsAndRules">If section is required If at
least one SC system in section B has B04 == true And  B10_ResidentialHvacAlterationType  ==
DuctSystemExistingExtended  Or SpaceConditioningSystemAltered For each SC System in section B  which
satisfy these conditions do the following:  A. Require one row of data for each SC system in section D
D02 for which  C03_ResidentialHeatingSystemType  == GasPackagedFurnace.  B. Require one row of data
for each SC system in section E E02 where C07_ResidentialCoolingSystemType  == CentralPackagedAC,
CentralPackagedHP CentralLargePackagedAC, Or  CentralLargePackagedHP  And same packkaged unit is not
already listed in section D thus D02 !- E02.     C. If C13_DuctedIndoorUnitsCount GTE 1 require one
row of data to be entered in this table for each of that quantity.</xsd:documentation>
645                 <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>
646             </xsd:annotation>
647             <xsd:complexType>
648                 <xsd:sequence>
649                     <xsd:element name="TableAlteredSCDucts">
650                         <xsd:annotation>
651                             <xsd:documentation source="FieldText"/>
652                         </xsd:annotation>
653                         <xsd:complexType>
654                             <xsd:sequence>
655                                 <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
656                                     <xsd:complexType>
657                                         <xsd:sequence>
658                                             <xsd:element
name="F01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
659                                                 <xsd:annotation>
660                                                     <xsd:documentation source="FieldText">SC
System ID/ Name from CF1R</xsd:documentation>
661                                                     <xsd:documentation
source="CalculationsAndRules">Referencevalue from
B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
662                                                 </xsd:annotation>
663                                             </xsd:element>
664                                             <xsd:element
name="F02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
665                                                 <xsd:annotation>
666                                                     <xsd:documentation source="FieldText">SC
System Description of Area Served</xsd:documentation>
```



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667                                                     <xsd:documentation
source="CalculationsAndRules">Reference value from
B02_ResidentialHvacSystemAreaServed</xsd:documentation>
668                                                 </xsd:annotation>
669                                             </xsd:element>
670                                             <xsd:element name="F03_IndoorUnitName"
type="hvac:IndoorUnitName">
671                                                 <xsd:annotation>
672                                                     <xsd:documentation source="FieldText">Indoor
Unit Name or  Description of  Area Served</xsd:documentation>
673                                                     <xsd:documentation
source="CalculationsAndRules">If any of these conditions are true: C03_ResidentialHeatingSystemType ==
GasPackagedFurnace; C03_ResidentialHeatingSystemType Or C07_ResidentialCoolingSystemType  ==
CentralPackagedAC, CentralPackagedHP CentralLargePackagedAC, Or  CentralLargePackagedHP;  Or
C12_IndoorUnitsCount = 1 then result = B02_ResidentialHvacSystemAreaServed;  Else user input maximum
15 characters;  Do not allow duplicate values for indoor unit names in this Mch01 as listed in F03 and
G03</xsd:documentation>
674                                                 </xsd:annotation>
675                                             </xsd:element>
676                                             <xsd:element name="F04_NewDuctingInstalled"
type="comp:NewDuctingInstalled">
677                                                 <xsd:annotation>
678                                                     <xsd:documentation source="FieldText">Was Any
New Ducting Installed?</xsd:documentation>
679                                                     <xsd:documentation
source="CalculationsAndRules">User selects from list; Yes (Boolean true), No (Boolean
false)</xsd:documentation>
680                                                 </xsd:annotation>
681                                             </xsd:element>
682                                             <xsd:choice maxOccurs="1">
683                                                 <xsd:element name="F05_DuctRValueLimit">
684                                                     <xsd:annotation>
685                                                         <xsd:documentation
source="FieldText">Required New Duct R-Value</xsd:documentation>
686                                                         <xsd:documentation
source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
NotApplicableMessage; Else If B07_Installing40PlusLinearFeetDucts == false result = R-6; Else If
A02_ClimateZone in InclusiveRange(1, 10) Or == 12 Or == 13 result = R-6; Else If  A02_ClimateZone ==
11, 14, 15 Or 16 result = R-8.</xsd:documentation>
687                                                     </xsd:annotation>
688                                                     <xsd:simpleType>
689                                                         <xsd:restriction
base="hvac:DuctRValueLimit">
690                                                             <xsd:enumeration value="R6"/>
691                                                             <xsd:enumeration value="R8"/>
692                                                         </xsd:restriction>
693                                                     </xsd:simpleType>
694                                                 </xsd:element>
695                                                 <xsd:element name="F05_NotApplicableMessage"
type="comp:NotApplicableMessage">
696                                                     <xsd:annotation>
697                                                         <xsd:documentation
source="FieldText">Required New Duct R-Value</xsd:documentation>
698                                                         <xsd:documentation
source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
NotApplicableMessage; Else If B07_Installing40PlusLinearFeetDucts == false result = R-6; Else If
A02_ClimateZone in InclusiveRange(1, 10) Or == 12 Or == 13 result = R-6; Else If  A02_ClimateZone ==
11, 14, 15 Or 16 result = R-8.</xsd:documentation>
699                                                     </xsd:annotation>
700                                                 </xsd:element>
701                                             </xsd:choice>
702                                             <xsd:choice maxOccurs="1">
703                                                 <xsd:element name="F06_SupplyDuctLocation"
type="hvac:SupplyDuctLocation">
704                                                     <xsd:annotation>
705                                                         <xsd:documentation
```

```
source="FieldText">Installed New Supply Duct Location</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
    NotApplicableMessage; Else user selects from list: ConditionedSpace display term Conditioned
    space-entirely, UnconditionedAttic display term Unconditioned attic, UnconditionedCrawlSpace display
    term Unconditioned crawl space, ControlledVentilationCrawlSpace display term Controlled ventilation
    crawl space, UnconditionedGarage display term Unconditioned garage, UnconditionedBasement display term
    Unconditioned basement, Outdoors display term Outdoors</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                            <xsd:element name="F06_NotApplicableMessage"
    type="comp:NotApplicableMessage">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Supply Duct Location</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
    NotApplicableMessage; Else user selects from list: ConditionedSpace display term Conditioned
    space-entirely, UnconditionedAttic display term Unconditioned attic, UnconditionedCrawlSpace display
    term Unconditioned crawl space, ControlledVentilationCrawlSpace display term Controlled ventilation
    crawl space, UnconditionedGarage display term Unconditioned garage, UnconditionedBasement display term
    Unconditioned basement, Outdoors display term Outdoors</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                        </xsd:choice>
                                        <xsd:choice maxOccurs="1">
                                            <xsd:element name="F07_DuctRValue">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Supply Duct R-value</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
    Else User picks from list: R4.2, R-6, R-8, R-10 and R-12.  Check value for compliance:  If result  GTE
    R4.2 And F10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned result complies; Else If
    result  GTE F05_DuctRvaluelimit result complies; Flag result as non-compliance and do not allow
    registration to proceed if not in compliance..</xsd:documentation>
                                                </xsd:annotation>
                                                <xsd:simpleType>
                                                    <xsd:restriction base="hvac:DuctRValue">
                                                        <xsd:enumeration value="R10"/>
                                                        <xsd:enumeration value="R12"/>
                                                        <xsd:enumeration value="R4.2"/>
                                                        <xsd:enumeration value="R6"/>
                                                        <xsd:enumeration value="R8"/>
                                                    </xsd:restriction>
                                                </xsd:simpleType>
                                            </xsd:element>
                                            <xsd:element name="F07_NotApplicableMessage"
    type="comp:NotApplicableMessage">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Supply Duct R-value</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
    Else User picks from list: R4.2, R-6, R-8, R-10 and R-12.  Check value for compliance:  If result  GTE
    R4.2 And F10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned result complies; Else If
    result  GTE F05_DuctRvaluelimit result complies; Flag result as non-compliance and do not allow
    registration to proceed if not in compliance..</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                        </xsd:choice>
                                        <xsd:choice maxOccurs="1">
                                            <xsd:element name="F08_ReturnDuctLocation"
    type="hvac:ReturnDuctLocation">
                                                <xsd:annotation>
                                                    <xsd:documentation
```

```
source="FieldText">Installed New Return Duct Location</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
    NotApplicableMessage; Else user selects from list: ConditionedSpace display term Conditioned
    space-entirely, UnconditionedAttic display term Unconditioned attic, UnconditionedCrawlSpace display
    term Unconditioned crawl space, ControlledVentilationCrawlSpace display term Controlled ventilation
    crawl space, UnconditionedGarage display term Unconditioned garage, UnconditionedBasement display term
    Unconditioned basement, Outdoors display term Outdoors</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                            <xsd:element name="F08_NotApplicableMessage"
    type="comp:NotApplicableMessage">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Return Duct Location</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04_NewDuctionInstalled == false  result = NotApplicable stored in
    NotApplicableMessage; Else user selects from list: ConditionedSpace display term Conditioned
    space-entirely, UnconditionedAttic display term Unconditioned attic, UnconditionedCrawlSpace display
    term Unconditioned crawl space, ControlledVentilationCrawlSpace display term Controlled ventilation
    crawl space, UnconditionedGarage display term Unconditioned garage, UnconditionedBasement display term
    Unconditioned basement, Outdoors display term Outdoors</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                        </xsd:choice>
                                        <xsd:choice maxOccurs="1">
                                            <xsd:element name="F09_DuctRValue">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Return Duct R-Value</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
    Else User picks from list: R4.2, R-6, R-8, R-10 and R-12.  Check value for compliance:  If result  GTE
    R4.2 And F10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned result complies; Else If
    result  GTE F05_DuctRvaluelimit result complies; Flag result as non-compliance and do not allow
    registration to proceed if not in compliance..</xsd:documentation>
                                                </xsd:annotation>
                                                <xsd:simpleType>
                                                    <xsd:restriction base="hvac:DuctRValue">
                                                        <xsd:enumeration value="R10"/>
                                                        <xsd:enumeration value="R12"/>
                                                        <xsd:enumeration value="R4.2"/>
                                                        <xsd:enumeration value="R6"/>
                                                        <xsd:enumeration value="R8"/>
                                                    </xsd:restriction>
                                                </xsd:simpleType>
                                            </xsd:element>
                                            <xsd:element name="F09_NotApplicableMessage"
    type="comp:NotApplicableMessage">
                                                <xsd:annotation>
                                                    <xsd:documentation
    source="FieldText">Installed New Return Duct R-Value</xsd:documentation>
                                                    <xsd:documentation
    source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
    Else User picks from list: R4.2, R-6, R-8, R-10 and R-12.  Check value for compliance:  If result  GTE
    R4.2 And F10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned result complies; Else If
    result  GTE F05_DuctRvaluelimit result complies; Flag result as non-compliance and do not allow
    registration to proceed if not in compliance..</xsd:documentation>
                                                </xsd:annotation>
                                            </xsd:element>
                                        </xsd:choice>
                                        <xsd:choice>
                                            <xsd:element
    name="F10_DuctMinimumRValueExceptions" type="comp:DuctMinimumRValueExceptions" maxOccurs="unbounded">
                                                <xsd:annotation>
                                                    <xsd:documentation
```

```
source="FieldText">Exemption from Min R-Value</xsd:documentation>
780                                                    <xsd:documentation
      source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
      Else default result = NoExemption.  Allow user to override default and select one or both of the
      following: UninsulatedInWallCavities display term Uninsulated Ducts In Wall Cavities,
      UninsulatedInDirectConditioning display term Uninsulated Ducts In directly conditioned space. ALSO If
      F06_SupplyDuctLocation And F08_ReturnDuctLocation == ConditionedSpace allow user to select
      RValueGTE4_2EntirelyInConditioned display term Ducts greater than or equal to R4.2 Entirely in
      Conditioned Space</xsd:documentation>
781                                                    </xsd:annotation>
782                                                </xsd:element>
783                                                <xsd:element name="F10_NotApplicableMessage"
      type="comp:NotApplicableMessage">
784                                                    <xsd:annotation>
785                                                        <xsd:documentation
      source="FieldText">Exemption from Min R-Value</xsd:documentation>
786                                                        <xsd:documentation
      source="CalculationsAndRules">If F04 == false result = NotApplicable stored in NotApplicableMessage;
      Else default result = NoExemption.  Allow user to override default and select one or both of the
      following: UninsulatedInWallCavities display term Uninsulated Ducts In Wall Cavities,
      UninsulatedInDirectConditioning display term Uninsulated Ducts In directly conditioned space. ALSO If
      F06_SupplyDuctLocation And F08_ReturnDuctLocation == ConditionedSpace allow user to select
      RValueGTE4_2EntirelyInConditioned display term Ducts greater than or equal to R4.2 Entirely in
      Conditioned Space</xsd:documentation>
787                                                    </xsd:annotation>
788                                                </xsd:element>
789                                            </xsd:choice>
790                                            <xsd:element
      name="F11_CanRA3_3AirflowProtocolsTestSystem" type="comp:CanRA3_3AirflowProtocolsTestSystem">
791                                                <xsd:annotation>
792                                                    <xsd:documentation source="FieldText">Can
      Approved Airflow Protocols be used to test this System?</xsd:documentation>
793                                                    <xsd:documentation
      source="CalculationsAndRules">If C03_ResidentialHeatingSystemType Or C07_ResidentialCoolingSystemType
      == CentralSplitAC, CentralSplitHP, CentralPackagedAC, CentralPackagedHP CentralLargePackagedAC, Or
      CentralLargePackagedHP result = true; Else user selects from list: Yes (Boolean true value), No
      (Boolean false value).  Compliance check: If result == false then report in project status notes field
      that exemption from mandatory HERS verification of system airflow has been claimed.  Enforcement
      agency confirmation is recommended.</xsd:documentation>
794                                                </xsd:annotation>
795                                            </xsd:element>
796                                            <xsd:choice maxOccurs="1">
797                                                <xsd:element
      name="F12_IndoorUnitNominalCoolingCapacity" type="hvac:IndoorUnitNominalCoolingCapacity">
798                                                    <xsd:annotation>
799                                                        <xsd:documentation
      source="FieldText">Indoor Unit Nominal Cooling capacity (ton)</xsd:documentation>
800                                                        <xsd:documentation
      source="CalculationsAndRules">If C12_IndoorUnitsCount GT 1 And one of the following is true:
      J08_AHU_AirflowRateVerificationRequired == true Or J05_DuctLeakageTestRequired == true, user input
      numeric value x.xx; Else result = NotApplicable stored in NotApplicableMessage</xsd:documentation>
801                                                    </xsd:annotation>
802                                                </xsd:element>
803                                                <xsd:element name="F12_NotApplicableMessage"
      type="comp:NotApplicableMessage">
804                                                    <xsd:annotation>
805                                                        <xsd:documentation
      source="FieldText">Indoor Unit Nominal Cooling capacity (ton)</xsd:documentation>
806                                                        <xsd:documentation
      source="CalculationsAndRules">If C12_IndoorUnitsCount GT 1 And one of the following is true:
      J08_AHU_AirflowRateVerificationRequired == true Or J05_DuctLeakageTestRequired == true, user input
      numeric value x.xx; Else result = NotApplicable stored in NotApplicableMessage</xsd:documentation>
807                                                    </xsd:annotation>
808                                                </xsd:element>
809                                            </xsd:choice>
810                                        </xsd:sequence>
```

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                                        </xsd:complexType>
                                    </xsd:element>
                                </xsd:sequence>
                            </xsd:complexType>
                        </xsd:element>
                        <xsd:element name="F12a_SectionComments" type="comp:SectionComments"
minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Notes:</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="Section_G" minOccurs="0" maxOccurs="1">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">Installed New or Complete Replacement Duct
System Information</xsd:documentation>
                    <xsd:documentation source="CalculationsAndRules">This Section is applicable only
if  one or more systems in section B has  B08_
DuctSystemAllAccessibleForSealingWithPlus75PercentNewReplaced == true; For SC systems that satisfy
this condition, do the following:  A. Require one row of data for each SC system in section D D02 for
which  C03_ResidentialHeatingSystemType  == GasPackagedFurnace.  B. Require one row of data for each
SC system in section E E02 where C07_ResidentialCoolingSystemType  == CentralPackagedAC,
CentralPackagedHP CentralLargePackagedAC, Or  CentralLargePackagedHP  And same packkaged unit is not
already listed in section D thus D02 !- E02.     C. If C13_DuctedIndoorUnitsCount GTE 1 require one
row of data to be entered in this table for each of that quantity.</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="TableDuctSystem">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText"/>
                            </xsd:annotation>
                            <xsd:complexType>
                                <xsd:sequence>
                                    <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
                                        <xsd:complexType>
                                            <xsd:sequence>
                                                <xsd:element
name="G01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
System ID/ Name from CF1R</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">Referencevalue from
B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element
name="G02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">SC
System Description of Area Served</xsd:documentation>
                                                        <xsd:documentation
source="CalculationsAndRules">Reference value from
B02_ResidentialHvacSystemAreaServed</xsd:documentation>
                                                    </xsd:annotation>
                                                </xsd:element>
                                                <xsd:element name="G03_IndoorUnitName"
type="hvac:IndoorUnitName">
                                                    <xsd:annotation>
                                                        <xsd:documentation source="FieldText">Indoor
```

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        Unit Name or  Description of  Area Served</xsd:documentation>
856                                                 <xsd:documentation
        source="CalculationsAndRules">If any of these conditions are true: C03_ResidentialHeatingSystemType ==
        GasPackagedFurnace; C03_ResidentialHeatingSystemType Or C07_ResidentialCoolingSystemType  ==
        CentralPackagedAC, CentralPackagedHP CentralLargePackagedAC, Or  CentralLargePackagedHP;  Or
        C12_IndoorUnitsCount = 1 then result = B02_ResidentialHvacSystemAreaServed;  Else user input maximum
        15 characters;  Do not allow duplicate values for indoor unit names in this Mch01 as listed in F03 and
        G03</xsd:documentation>
857                                             </xsd:annotation>
858                                         </xsd:element>
859                                         <xsd:element name="G04_IndoorUnitDucts">
860                                             <xsd:annotation>
861                                                 <xsd:documentation source="FieldText">Total
        Duct Length</xsd:documentation>
862                                                 <xsd:documentation
        source="CalculationsAndRules">User selects from list: DuctsLTE10Ft  display term Ducted less than or
        equal to 10ft length, DuctsGT10Ft display term Ducted greater than 10ft length</xsd:documentation>
863                                             </xsd:annotation>
864                                             <xsd:simpleType>
865                                                 <xsd:restriction base="hvac:IndoorUnitDucts">
866                                                     <xsd:enumeration value="DuctsGT10Ft"/>
867                                                     <xsd:enumeration value="DuctsLTE10Ft"/>
868                                                 </xsd:restriction>
869                                             </xsd:simpleType>
870                                         </xsd:element>
871                                         <xsd:element name="G05_DuctRValueLimit">
872                                             <xsd:annotation>
873                                                 <xsd:documentation source="FieldText">Required
        New Duct R-Value</xsd:documentation>
874                                                 <xsd:documentation
        source="CalculationsAndRules">Calculated field:  If A02_ClimateZone InclusiveRange (1, 10) Or
        A02_ClimateZone == 12 Or 13  result = R6,  Else If A02_ClimateZone == 11, 14, 15 Or 16 result =
        R8</xsd:documentation>
875                                             </xsd:annotation>
876                                             <xsd:simpleType>
877                                                 <xsd:restriction base="hvac:DuctRValueLimit">
878                                                     <xsd:enumeration value="R6"/>
879                                                     <xsd:enumeration value="R8"/>
880                                                 </xsd:restriction>
881                                             </xsd:simpleType>
882                                         </xsd:element>
883                                         <xsd:element name="G06_SupplyDuctLocation"
        type="hvac:SupplyDuctLocation">
884                                             <xsd:annotation>
885                                                 <xsd:documentation source="FieldText">Supply
        Duct Location</xsd:documentation>
886                                                 <xsd:documentation
        source="CalculationsAndRules">User selects from list: ConditionedSpace display term Conditioned
        space-entirely, ConditionedSpaceExcept12ft display term Conditioned space - except 12ft,
        UnconditionedCrawlSpace display term Unconditioned crawl space, ControlledVentilationCrawlSpace
        display term Controlled ventilation crawl space, UnconditionedAttic display term Unconditioned attic,
        UnconditionedBasement display term Unconditioned basement, UnconditionedGarage display term
        Unconditioned garage, Outdoors display term Outdoors</xsd:documentation>
887                                             </xsd:annotation>
888                                         </xsd:element>
889                                         <xsd:element name="G07_DuctRValue">
890                                             <xsd:annotation>
891                                                 <xsd:documentation source="FieldText">New or
        Replaced Supply Duct R-Value</xsd:documentation>
892                                                 <xsd:documentation
        source="CalculationsAndRules">User picks from list: R-4.2, R-6, R-8, R-10 and R-12.  Check result:  If
        result GTE G05_DuctRValueLimit, it complies subject to this exception: If
        G10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned, then R4_2 complies.  Flag
        non-compliant values and do not allow registration to proceed if not in
        compliance.</xsd:documentation>
893                                             </xsd:annotation>
```

```
894                                                 <xsd:simpleType>
895                                                     <xsd:restriction base="hvac:DuctRValue">
896                                                         <xsd:enumeration value="R10"/>
897                                                         <xsd:enumeration value="R12"/>
898                                                         <xsd:enumeration value="R4.2"/>
899                                                         <xsd:enumeration value="R6"/>
900                                                         <xsd:enumeration value="R8"/>
901                                                     </xsd:restriction>
902                                                 </xsd:simpleType>
903                                             </xsd:element>
904                                             <xsd:element name="G08_ReturnDuctLocation"
    type="hvac:ReturnDuctLocation">
905                                                 <xsd:annotation>
906                                                     <xsd:documentation source="FieldText">Return
    Duct Location</xsd:documentation>
907                                                     <xsd:documentation
    source="CalculationsAndRules">User selects from list: ConditionedSpace display term Conditioned
    space-entirely, ConditionedSpaceExcept12ft display term Conditioned space - except 12ft,
    UnconditionedCrawlSpace display term Unconditioned crawl space, ControlledVentilationCrawlSpace
    display term Controlled ventilation crawl space, UnconditionedAttic display term Unconditioned attic,
    UnconditionedBasement display term Unconditioned basement, UnconditionedGarage display term
    Unconditioned garage, Outdoors display term Outdoors</xsd:documentation>
908                                                 </xsd:annotation>
909                                             </xsd:element>
910                                             <xsd:element name="G09_DuctRValue">
911                                                 <xsd:annotation>
912                                                     <xsd:documentation source="FieldText">New or
    Replaced  Return Duct R-Value</xsd:documentation>
913                                                     <xsd:documentation
    source="CalculationsAndRules">User picks from list: R-4.2, R-6, R-8, R-10 and R-12.  Check result:  If
    result GTE G05_DuctRValueLimit, it complies subject to this exception: If
    G10_DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned, then R-4.2 complies.  Flag
    non-compliant values and do not allow registration to proceed if not in
    compliance.</xsd:documentation>
914                                                 </xsd:annotation>
915                                                 <xsd:simpleType>
916                                                     <xsd:restriction base="hvac:DuctRValue">
917                                                         <xsd:enumeration value="R10"/>
918                                                         <xsd:enumeration value="R12"/>
919                                                         <xsd:enumeration value="R4.2"/>
920                                                         <xsd:enumeration value="R6"/>
921                                                         <xsd:enumeration value="R8"/>
922                                                     </xsd:restriction>
923                                                 </xsd:simpleType>
924                                             </xsd:element>
925                                             <xsd:sequence maxOccurs="unbounded">
926                                                 <xsd:annotation>
927                                                     <xsd:documentation
    source="FieldText">Exemption from Minimum R-Value</xsd:documentation>
928                                                     <xsd:documentation
    source="CalculationsAndRules">Default result = NoExemtions;  Allow user to override the default and
    select one or more of the following: UninsulatedInWallCavities display term Uninsulated Ducts In Wall
    Cavities,  UninsulatedInDirectConditioning display term Uninsulated Ducts In directly conditioned
    space;  If G06_SupplyDuctLocation And G08_ReturnDuctLocation  == ConditionedSpace, then add to list
    RValueGTE4_2EntirelyInConditioned display term Ducts
929                                                 <d:gte/>R4.2 Entirely in Conditioned
    Space</xsd:documentation>
930                                                 </xsd:annotation>
931                                                 <xsd:element
    name="G10_DuctMinimumRValueExceptions" type="comp:DuctMinimumRValueExceptions"/>
932                                             </xsd:sequence>
933                                             <xsd:element
    name="G11_DuctFilterGrilleSizingComplianceMethod">
934                                                 <xsd:annotation>
935                                                     <xsd:documentation source="FieldText">Method
    of compliance with Airflow and Fan Efficacy Req's in 150.0(m)13</xsd:documentation>
```

```
936                                                     <xsd:documentation
source="CalculationsAndRules">If C07_ResidentialCoolingSystemType == NoCooling Then result =
ExemptNoCooling, display text: Exempt - No Cooling,  Else If  C07_ResidentialCoolingSystemType ==
EvaporativeDirect,  EvaporativeIndirect, or EvaporativeIndirectDirect,  then  result =
ExemptEvaporativeSystem, display text :Exempt - Evaporative System, else if
G13_CanRA3_3AirflowProtocolsTestSystem == false Then result is ExemptRA3_3Protocols display text:
Exempt - Approved Protocols are N/A;   Else If B08_AllNewOrReplacedHvacSystem == true And
C14_IsVentilationSystemCFI == true then result = HERS_FanEfficacyAirflowRateNewReplace display text,
HERS verified fan efficacy (W/cfm) and airflow rate (cfm/ton);  Else user selects  from the following
values: 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>
937                                                 </xsd:annotation>
938                                                 <xsd:simpleType>
939                                                     <xsd:restriction
base="comp:DuctFilterGrilleSizingComplianceMethod">
940                                                         <xsd:enumeration
value="ExemptEvaporativeSystem"/>
941                                                         <xsd:enumeration value="ExemptNoCooling"/>
942                                                         <xsd:enumeration
value="ExemptRA3_3Protocols"/>
943                                                         <xsd:enumeration
value="HERS_FanEfficacyAirflowRate"/>
944                                                         <xsd:enumeration
value="HERS_ReturnDuctDesignTable150"/>
945                                                     </xsd:restriction>
946                                                 </xsd:simpleType>
947                                             </xsd:element>
948                                             <xsd:element name="G12_DuctSystemAirFilterDeviceCount"
type="hvac:DuctSystemAirFilterDeviceCount">
949                                                 <xsd:annotation>
950                                                     <xsd:documentation source="FieldText">Number
of Air Filter Devices on Indoor Units</xsd:documentation>
951                                                     <xsd:documentation
source="CalculationsAndRules">User input numeric integer;  Note: this value will determine the number
of rows per indoor unit in next section.</xsd:documentation>
952                                                 </xsd:annotation>
953                                             </xsd:element>
954                                             <xsd:element
name="G13_CanRA3_3AirflowProtocolsTestSystem" type="comp:CanRA3_3AirflowProtocolsTestSystem">
955                                                 <xsd:annotation>
956                                                     <xsd:documentation source="FieldText">Can
Approved Airflow Protocols be used to test this System?</xsd:documentation>
957                                                     <xsd:documentation
source="CalculationsAndRules">C03_ResidentialHeatingSystemType Or C07_ResidentialCoolingSystemType  ==
CentralSplitAC, CentralSplitHP, CentralPackagedAC, CentralPackagedHP CentralLargePackagedAC, Or
CentralLargePackagedHP result = true; Else user selects from list: Yes (Boolean true value), No
(Boolean false value).  Compliance check: If result == false then report in project status notes field
that exemption from mandatory HERS verification of system airflow has been claimed.  Enforcement
agency confirmation is recommended.  .</xsd:documentation>
958                                                 </xsd:annotation>
959                                             </xsd:element>
960                                             <xsd:element
name="G14_CanFanEfficacyProtocolsTestSystem" type="comp:CanFanEfficacyProtocolsTestSystem">
961                                                 <xsd:annotation>
962                                                     <xsd:documentation source="FieldText">Can
Approved Fan Efficacy Protocol be used to test this System?</xsd:documentation>
963                                                     <xsd:documentation
source="CalculationsAndRules">If system type in C03_ResidentialHeatingSystemType Or
C04_ResidentialCoolingSystemType == CentralSplitAC, CentralSplitHP,   CentralPackagedAC,
CentralPackagedHP, CentralLargePackagedAC Or CentralLargePackagedHP result = true display term yes;
Else user selects from list: Yes (Boolean true display text) or No  (Boolean false display text).
Check: if result == false, report in project status notes field that exemption from mandatory HERS
verification of system airflow has been claimed. Enforcement agency confirmation is
recommended.</xsd:documentation>
964                                                 </xsd:annotation>
```



```
                                                </xsd:element>
                                                <xsd:choice maxOccurs="1">
                                                    <xsd:element
    name="G15_IndoorUnitNominalCoolingCapacity" type="hvac:IndoorUnitNominalCoolingCapacity">
                                                        <xsd:annotation>
                                                            <xsd:documentation
    source="FieldText">Indoor Unit Nominal Cooling capacity (ton)</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">If C12_IndoorUnitsCount GT 1 And one of the following is true:
    J08_AHU_AirflowRateVerificationRequired == true Or J05_DuctLeakageTestRequired == true, user input
    numeric value x.xx; Else result = NotApplicable stored in NotApplicableMessage</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element name="G15_NotApplicableMessage"
    type="comp:NotApplicableMessage">
                                                        <xsd:annotation>
                                                            <xsd:documentation
    source="FieldText">Indoor Unit Nominal Cooling capacity (ton)</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">If C12_IndoorUnitsCount GT 1 And one of the following is true:
    J08_AHU_AirflowRateVerificationRequired == true Or J05_DuctLeakageTestRequired == true, user input
    numeric value x.xx; Else result = NotApplicable stored in NotApplicableMessage</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                </xsd:choice>
                                            </xsd:sequence>
                                        </xsd:complexType>
                                    </xsd:element>
                                </xsd:sequence>
                            </xsd:complexType>
                        </xsd:element>
                        <xsd:element name="G15a_SectionComments" type="comp:SectionComments"
    minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Notes</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="Section_H" minOccurs="0" maxOccurs="1">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">Installed Air Filter Device
    Information</xsd:documentation>
                    <xsd:documentation source="CalculationsAndRules">This Section is applicable only
    If section G is applicable And at  least one indoor unit has G04_IndoorUnitDucts == DuctsGT10Ft .
    Require one row of data for each of the air filter devices included in
    G12_DuctSystemAirFilterDeviceCount   for each indoor unit listed in G03_IndoorUnitName where
    G04_IndoorUnitDucts == DuctsGT10Ft</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="H_BeginNote1" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Begin Note 1</xsd:documentation>
                                <xsd:documentation source="AdditionalRequirements">Mandatory
    requirements for air filter devices are specified Section 150.0(m)12.  The installer shall place a
    sticker in or near the filter grille displaying the filter grille/rack design airflow rate and the
    maximum allowed clean filter pressure drop at the design airflow rate.  This will inform the occupant
    of the airflow vs pressure drop performance required for replacement air filters.</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                        <xsd:element name="TableAirFilterDevice">
```



```
                                <xsd:annotation>
                                    <xsd:documentation source="FieldText"/>
                                </xsd:annotation>
                                <xsd:complexType>
                                    <xsd:sequence>
                                        <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
                                            <xsd:complexType>
                                                <xsd:sequence>
                                                    <xsd:element
    name="H01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">SC
    System Identification or Name</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">Reference value from
    B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element
    name="H02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">SC
    System Location or Area Served</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">Reference value from B02_ResidentialHvacSystemAreaServed for this
    system</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element name="H03_IndoorUnitName"
    type="hvac:IndoorUnitName">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Indoor
    Unit Name or  Description of  Area Served</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">Auto-filled from G03_IndoorUnitName</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element name="H04_DuctSystemAirFilterDeviceName"
    type="hvac:DuctSystemAirFilterDeviceName">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Air
    Filter Name or  Description of  Location</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">User input text maximum 20 characters</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element name="H05_DuctSystemAirFilterDeviceType"
    type="hvac:DuctSystemAirFilterDeviceType">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Air
    Filter Device Type</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">User selects from list: DuctMounted display term Duct Mounted,
    FilterGrille display term Filter Grille, FurnaceMounted display term Furnace
    Mounted</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
                                                    <xsd:element name="H06_AirFilterDeviceAirflowRate"
    type="hvac:AirFilterDeviceAirflowRate">
                                                        <xsd:annotation>
                                                            <xsd:documentation source="FieldText">Design
    Airflow Rate for Air Filter Device (cfm)</xsd:documentation>
                                                            <xsd:documentation
    source="CalculationsAndRules">User input numeric xxxx</xsd:documentation>
                                                        </xsd:annotation>
                                                    </xsd:element>
```

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1053                                                <xsd:element name="H07_AirFilterDeviceDepth"
      type="hvac:AirFilterDeviceDepth">
1054                                                    <xsd:annotation>
1055                                                        <xsd:documentation source="FieldText">Air
      Filter Nominal Depth (inch)</xsd:documentation>
1056                                                        <xsd:documentation
      source="CalculationsAndRules">user input integer GTE 1</xsd:documentation>
1057                                                    </xsd:annotation>
1058                                                </xsd:element>
1059                                                <xsd:element name="H08_AirFilterDeviceLength"
      type="hvac:AirFilterDeviceLength">
1060                                                    <xsd:annotation>
1061                                                        <xsd:documentation source="FieldText">Air
      Filter Nominal Length (inch)</xsd:documentation>
1062                                                        <xsd:documentation
      source="CalculationsAndRules">User input integer GTE 1.00</xsd:documentation>
1063                                                    </xsd:annotation>
1064                                                </xsd:element>
1065                                                <xsd:element name="H09_AirFilterDeviceWidth"
      type="hvac:AirFilterDeviceWidth">
1066                                                    <xsd:annotation>
1067                                                        <xsd:documentation source="FieldText">Air
      Filter Nominal Width (inch)</xsd:documentation>
1068                                                        <xsd:documentation
      source="CalculationsAndRules">User input integer GTE 1.00</xsd:documentation>
1069                                                    </xsd:annotation>
1070                                                </xsd:element>
1071                                                <xsd:element name="H10_AirFilterDeviceFaceArea"
      type="hvac:AirFilterDeviceFaceArea">
1072                                                    <xsd:annotation>
1073                                                        <xsd:documentation source="FieldText">Air
      Filter Calculated Nominal Face Area (inch<d:sup>2</d:sup>)</xsd:documentation>
1074                                                        <xsd:documentation
      source="CalculationsAndRules">Calculated field: PRODUCT (H08_AirFilterDeviceLength,
      H09_AirFilterDeviceWidth )</xsd:documentation>
1075                                                    </xsd:annotation>
1076                                                </xsd:element>
1077                                                <xsd:choice maxOccurs="1">
1078                                                    <xsd:element
      name="H11_AirFilterDeviceFaceAreaRequiredMin" type="hvac:AirFilterDeviceFaceAreaRequiredMin">
1079                                                        <xsd:annotation>
1080                                                            <xsd:documentation source="FieldText">Air
      Filter Required Minimum Face Area (inch<d:sup>2</d:sup>)</xsd:documentation>
1081                                                            <xsd:documentation
      source="CalculationsAndRules">Calculated field; If H07_AirFilterDeviceDepth == 1 result =
      PRODUCT(H06_AirFilterDeviceAirflowRate / 150, 144) Else result = SpecifiedByDesigner stored in
      AirFilterDeviceFaceAreaMessage display term Specified by System Designer</xsd:documentation>
1082                                                        </xsd:annotation>
1083                                                    </xsd:element>
1084                                                    <xsd:element
      name="H11_AirFilterDeviceFaceAreaMessage" type="comp:AirFilterDeviceFaceAreaMessage">
1085                                                        <xsd:annotation>
1086                                                            <xsd:documentation source="FieldText">Air
      Filter Required Minimum Face Area (inch<d:sup>2</d:sup>)</xsd:documentation>
1087                                                            <xsd:documentation
      source="CalculationsAndRules">Calculated field; If H07_AirFilterDeviceDepth == 1 result =
      PRODUCT(H06_AirFilterDeviceAirflowRate / 150, 144) Else result = SpecifiedByDesigner stored in
      AirFilterDeviceFaceAreaMessage display term Specified by System Designer</xsd:documentation>
1088                                                        </xsd:annotation>
1089                                                    </xsd:element>
1090                                                </xsd:choice>
1091                                                <xsd:element
      name="H12_AirFilterDeviceFaceAreaCompliance" type="comp:AirFilterDeviceFaceAreaCompliance">
1092                                                    <xsd:annotation>
1093                                                        <xsd:documentation source="FieldText">Face
      Area  Compliance</xsd:documentation>
```

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1094                                                    <xsd:documentation source="CalculationsAndRules">Calculated field: If H11_AirFilterDeviceFaceAreaMessage == SpecifiedByDesigner result = SpecifiedByDesigner Else if H10_AirFilterDeviceFaceArea GTE H11_AirFilterDeviceFaceAreaRequiredMin result = FaceAreaComplies display term Complies esle result = FaceAreaDoesNotComply display term Does Not Comply</xsd:documentation>
1095                                                    </xsd:annotation>
1096                                                </xsd:element>
1097                                                <xsd:element name="H13_DuctSystemAirFilterDevicePressureDrop" type="hvac:DuctSystemAirFilterDevicePressureDrop">
1098                                                    <xsd:annotation>
1099                                                        <xsd:documentation source="FieldText">Design Allowable Pressure Drop for Air Filter Device (inch W.C.)</xsd:documentation>
1100                                                        <xsd:documentation source="CalculationsAndRules">If H07_AirFilterDeviceDepth == 1 result = 0.1 Else user input numeric x.xx</xsd:documentation>
1101                                                    </xsd:annotation>
1102                                                </xsd:element>
1103                                            </xsd:sequence>
1104                                        </xsd:complexType>
1105                                    </xsd:element>
1106                                </xsd:sequence>
1107                            </xsd:complexType>
1108                        </xsd:element>
1109                        <xsd:element name="H13a_SectionComments" type="comp:SectionComments" minOccurs="0">
1110                            <xsd:annotation>
1111                                <xsd:documentation source="FieldText">Notes:</xsd:documentation>
1112                            </xsd:annotation>
1113                        </xsd:element>
1114                    </xsd:sequence>
1115                </xsd:complexType>
1116            </xsd:element>
1117            <xsd:element name="Section_I" minOccurs="0" maxOccurs="1">
1118                <xsd:annotation>
1119                    <xsd:documentation source="FieldText">Air Filter Device Requirements</xsd:documentation>
1120                    <xsd:documentation source="CalculationsAndRules">This Section is applicable only if  section H applies</xsd:documentation>
1121                    <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>
1122                </xsd:annotation>
1123                <xsd:complexType>
1124                    <xsd:sequence>
1125                        <xsd:element name="I01" minOccurs="0">
1126                            <xsd:annotation>
1127                                <xsd:documentation source="FieldText">Recirculated and outdoor air filtering</xsd:documentation>
1128                                <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>
1129                            </xsd:annotation>
1130                        </xsd:element>
1131                        <xsd:element name="I02" minOccurs="0">
1132                            <xsd:annotation>
1133                                <xsd:documentation source="FieldText">Air Filter Device Requirements</xsd:documentation>
1134                                <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 shall be determined by the system designer.  The system installer shall affix a sticker/label to each system air filter grille/rack locations that discloses the filter's design airflow rate and the filter's maximum allowable clean-filter pressure drop at the design airflow rate.  The sticker/labels shall be permanently affixed to the air filter grille/rack, readily legible, and visible to a person replacing the air filter.</xsd:documentation>
1135                            </xsd:annotation>
```

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                        </xsd:element>
                        <xsd:element name="I03" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Air filter access and regular service</xsd:documentation>
                                <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>
                            </xsd:annotation>
                        </xsd:element>
                        <xsd:element name="I04" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Air filter media efficiency</xsd:documentation>
                                <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% in the 0.30 to1.0
                                <d:micron/>m range and equal to or greater than 85 percent in the 1.0 - 3.0
                                <d:micron/>m range when tested in accordance with AHRI Standard 680.</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                        <xsd:element name="I05" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">Air filter media manufacturer label</xsd:documentation>
                                <xsd:documentation source="AdditionalRequirements">The system shall be provided with air filters that have been labeled by the manufacturer to disclose efficiency and pressure drop ratings that conform to the efficiency and pressure drop requirements for the air filter grilles/racks..</xsd:documentation>
                            </xsd:annotation>
                        </xsd:element>
                        <xsd:element name="IEndNote1" minOccurs="0">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
                                <xsd:documentation source="AdditionalRequirements">The responsible person's 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:element name="Section_J" minOccurs="0" maxOccurs="1">
                <xsd:annotation>
                    <xsd:documentation source="FieldText">HERS Verification Requirements for Duct Systems</xsd:documentation>
                    <xsd:documentation source="CalculationsAndRules">This section applies if either section F or section G applies. In that case rRequire one row of data in this table for each of the indoor units listed in F03_IndoorUnitName and require one row of data for each indoor unit listed in G03_IndoorUnitName</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="TableHERSDucts">
                            <xsd:annotation>
                                <xsd:documentation source="FieldText"/>
                            </xsd:annotation>
                            <xsd:complexType>
                                <xsd:sequence>
                                    <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
                                        <xsd:complexType>
```

```
1182                                        <xsd:sequence>
1183                                            <xsd:element
name="J01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
1184                                                <xsd:annotation>
1185                                                    <xsd:documentation source="FieldText">SC
System Identification or Name</xsd:documentation>
1186                                                    <xsd:documentation
source="CalculationsAndRules">Reference B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
1187                                                </xsd:annotation>
1188                                            </xsd:element>
1189                                            <xsd:element
name="J02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
1190                                                <xsd:annotation>
1191                                                    <xsd:documentation source="FieldText">SC
System Description of Area Served</xsd:documentation>
1192                                                    <xsd:documentation
source="CalculationsAndRules">Reference B02_ResidentialHvacSystemAreaServed for this
system</xsd:documentation>
1193                                                </xsd:annotation>
1194                                            </xsd:element>
1195                                            <xsd:element name="J03_IndoorUnitName"
type="hvac:IndoorUnitName">
1196                                                <xsd:annotation>
1197                                                    <xsd:documentation source="FieldText">Indoor
Unit Name or  Description of  Area Served</xsd:documentation>
1198                                                    <xsd:documentation
source="CalculationsAndRules">Auto-filled from F03_IndoorUnitName or
G03_IndoorUnitName</xsd:documentation>
1199                                                </xsd:annotation>
1200                                            </xsd:element>
1201                                            <xsd:element name="J04_DuctLeakageTestExemption"
type="comp:DuctLeakageTestExemption">
1202                                                <xsd:annotation>
1203                                                    <xsd:documentation
source="FieldText">Exemption From Duct Leakage Requirements</xsd:documentation>
1204                                                    <xsd:documentation
source="CalculationsAndRules">Calculated field:  Default result for DuctLeakageTestExemption =
NoExemptions;  Allow user to override the default and select one of the following exemptions:
DuctsSealedTested_HERSCertified display text: Ducts have previously been sealed, tested, and certified
by a HERS rater,   DuctLessThan40Feet display text: Duct system has less than 40 ft of duct.  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>
1205                                                </xsd:annotation>
1206                                            </xsd:element>
1207                                            <xsd:element name="J05_DuctLeakageTestRequired"
type="comp:DuctLeakageTestRequired">
1208                                                <xsd:annotation>
1209                                                    <xsd:documentation source="FieldText">MCH-20
1210                                                <d:line4/>Duct Leakage Test</xsd:documentation>
1211                                                    <xsd:documentation
source="CalculationsAndRules">Calculated field: If  J04_DuctLeakageTestExemption !=  NoExemptions Then
result = 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. Constrain user  input for B04-B09 to allow only available combinations of responses
given in teh Logic Table.   If the term DctLk appears in the HERS column, Then result is true (duct
leakage test required);
1212    Else If DctLk does not appear in the HERS column, then result is false.  Display Yes if result ==
true and No if result == false.</xsd:documentation>
1213                                                </xsd:annotation>
1214                                            </xsd:element>
1215                                            <xsd:element
name="J06_DuctsInConditionedSpaceVerification" type="comp:DuctsInConditionedSpaceVerification">
1216                                                <xsd:annotation>
1217                                                    <xsd:documentation source="FieldText">MCH-21
1218                                                <d:line2/>Duct Location Verification</xsd:documentation>
```

```
1219                                                    <xsd:documentation
source="CalculationsAndRules">Calculated field:  If applicable value in F10 Or G10
DuctMinimumRValueExceptions == RValueGTE4_2EntirelyInConditioned And one of the following is true:
applicable values in G07_DuctRVal ue Or G09_DuctRVal ue are LT G05_DuctRVal ueLimit Or applicable values
in F07 Or F09 DuctRvalue are LT F05  result = true; Else If applicable values F10 Or
G10_DuctMinimumRValueExceptions == UninsulatedInWallCavities Or UninsulatedInDirectConditioning result
= true; Else result = false.  Display Yes if result ==  true and No if result ==
false.</xsd:documentation>
1220                                                    </xsd:annotation>
1221                                                </xsd:element>
1222                                                <xsd:element
name="J07_AHU_FanEfficacyVerificationRequired" type="comp:AHU_FanEfficacyVerificationRequired">
1223                                                    <xsd:annotation>
1224                                                        <xsd:documentation source="FieldText">MCH-22
1225                                                <d:line3/>AHU Fan Efficacy (W/cfm)</xsd:documentation>
1226                                                        <xsd:documentation
source="CalculationsAndRules">Calculated field: If G14_CanFanEfficacyProtocolsTestSystem == false
result = false;  Else if G11_DuctFilterGrilleSizingComplianceMethod = HERS_FanEfficacyAirflowRate then
result = true; else if B09_AllNewOrReplacedHvacSystem = true And C07_ResidentialCoolingSystemType =
NoCooling  And C14 IsVentialationSystemCFI == true, And G13_CanRA3_3AirflowProtocolsTestSystem == true
And, G14_CanFanEfficacyProtocolsTestSystem== true then result = true;  Else result = false.  Display
Yes if result ==  true and No if result == false.</xsd:documentation>
1227                                                    </xsd:annotation>
1228                                                </xsd:element>
1229                                                <xsd:element
name="J08_AHU_AirflowRateVerificationRequired" type="comp:AHU_AirflowRateVerificationRequired">
1230                                                    <xsd:annotation>
1231                                                        <xsd:documentation source="FieldText">MCH-23
1232                                                <d:line2/>AHU Airflow Rate (cfm/ton)</xsd:documentation>
1233                                                        <xsd:documentation
source="CalculationsAndRules">Calculated field:   If G11_DuctFilterGrilleSizingComplianceMethod ==
HERS_FanEfficacyAirflowRate then result = true;  Else If K03_RefrigerantChargeVerificationRequired  ==
true And J09_ReturnDuctDesignVerificationRequired == false; then result = true;  else if B09
AllNewOrReplacedHvacSystem == true And C07_ResidentialCoolingSystemType == NoCooling  And C14
IsVentialationSystemCFI == true, And G13_CanRA3_3AirflowProtocolsTestSystem == true And,
G14_CanFanEfficacyProtocolsTestSystem== true then result = true;  Else result is false. Display Yes if
result ==  true and No if result == false.</xsd:documentation>
1234                                                    </xsd:annotation>
1235                                                </xsd:element>
1236                                                <xsd:element
name="J09_ReturnDuctDesignVerificationRequired" type="comp:ReturnDuctDesignVerificationRequired">
1237                                                    <xsd:annotation>
1238                                                        <xsd:documentation source="FieldText">MCH-28
1239                                                <d:line2/>Return Duct Design - Table 150.0-B or
C</xsd:documentation>
1240                                                        <xsd:documentation
source="CalculationsAndRules">Calculated field:  If G11_DuctFilterGrilleSizingComplianceMethod ==
HERS_ReturnDuctDesignTable150BC then result = true;  Else result = false.   Display Yes if result ==
true and No if result == false.</xsd:documentation>
1241                                                    </xsd:annotation>
1242                                                </xsd:element>
1243                                            </xsd:sequence>
1244                                        </xsd:complexType>
1245                                    </xsd:element>
1246                                </xsd:sequence>
1247                            </xsd:complexType>
1248                        </xsd:element>
1249                        <xsd:element name="J09a_SectionComments" type="comp:SectionComments"
minOccurs="0">
1250                            <xsd:annotation>
1251                                <xsd:documentation source="FieldText">Notes:</xsd:documentation>
1252                            </xsd:annotation>
1253                        </xsd:element>
1254                    </xsd:sequence>
1255                </xsd:complexType>
1256            </xsd:element>
```

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1257              <xsd:element name="Section_K" minOccurs="1">
1258                  <xsd:annotation>
1259                      <xsd:documentation source="FieldText">HERS Verification Requirements For Space
      Conditioning Equipment</xsd:documentation>
1260                      <xsd:documentation source="CalculationsAndRules">Require one row of data for each
      SC System listed in C01_ResidentialSpaceConditioningSystemName</xsd:documentation>
1261                      <xsd:documentation source="MinOccurs">This section is
      required.</xsd:documentation>
1262                  </xsd:annotation>
1263                  <xsd:complexType>
1264                      <xsd:sequence>
1265                          <xsd:element name="TableHERSEquipment">
1266                              <xsd:annotation>
1267                                  <xsd:documentation source="FieldText"/>
1268                              </xsd:annotation>
1269                              <xsd:complexType>
1270                                  <xsd:sequence>
1271                                      <xsd:element name="Row" minOccurs="1" maxOccurs="unbounded">
1272                                          <xsd:complexType>
1273                                              <xsd:sequence>
1274                                                  <xsd:element
      name="K01_ResidentialSpaceConditioningSystemName" type="hvac:ResidentialSpaceConditioningSystemName">
1275                                                      <xsd:annotation>
1276                                                          <xsd:documentation source="FieldText">SC
      System ID/ Name from CF1R</xsd:documentation>
1277                                                          <xsd:documentation
      source="CalculationsAndRules">Auto-filled from
      B01_ResidentialSpaceConditioningSystemName</xsd:documentation>
1278                                                      </xsd:annotation>
1279                                                  </xsd:element>
1280                                                  <xsd:element
      name="K02_ResidentialHvacSystemAreaServed" type="hvac:ResidentialHvacSystemAreaServed">
1281                                                      <xsd:annotation>
1282                                                          <xsd:documentation source="FieldText">SC
      System Description of Area Served</xsd:documentation>
1283                                                          <xsd:documentation
      source="CalculationsAndRules">Auto-filled from B02_ResidentialHvacSystemAreaServed</xsd:documentation>
1284                                                      </xsd:annotation>
1285                                                  </xsd:element>
1286                                                  <xsd:element
      name="K03_RefrigerantChargeVerificationRequired" type="comp:RefrigerantChargeVerificationRequired">
1287                                                      <xsd:annotation>
1288                                                          <xsd:documentation source="FieldText">MCH-25
1289                                                  <d:line3/>Refrigerant Charge</xsd:documentation>
1290                                                          <xsd:documentation
      source="CalculationsAndRules">Calculated Field: If C03_ResidentialHeatingSystemType Or
      C07_ResidentialCoolingSystemType  ==  NonAirSourceHP Or NonAirCooledAC result = false Else   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. Constrain user  input
      for B04-B09 to allow only available combinations of responses given in the Logic Table.  If "RC"
      appears in the HERS column And  If  A02_ClimateZone == 2 Or InclusiveRange(8,15) then result = true;
      Else result = false. Display Yes and No to represent Boolean values true and
      false.</xsd:documentation>
1291                                                      </xsd:annotation>
1292                                                  </xsd:element>
1293                                              </xsd:sequence>
1294                                          </xsd:complexType>
1295                                      </xsd:element>
1296                                  </xsd:sequence>
1297                              </xsd:complexType>
1298                          </xsd:element>
1299                          <xsd:element name="K03a_SectionComments" type="comp:SectionComments"
      minOccurs="0">
1300                              <xsd:annotation>
1301                                  <xsd:documentation source="FieldText">Notes</xsd:documentation>
1302                              </xsd:annotation>
```



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1303                        </xsd:element>
1304                    </xsd:sequence>
1305                </xsd:complexType>
1306            </xsd:element>
1307            <xsd:element name="Section_L" minOccurs="0">
1308                <xsd:annotation>
1309                    <xsd:documentation source="FieldText">Space Conditioning Systems, Ducts and Fans Mandatory Requirements and Additional Measures</xsd:documentation>
1310                    <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>
1311                </xsd:annotation>
1312                <xsd:complexType>
1313                    <xsd:sequence>
1314                        <xsd:element name="L_BeginNote1" minOccurs="0">
1315                            <xsd:annotation>
1316                                <xsd:documentation source="FieldText">Begin Note 1</xsd:documentation>
1317                                <xsd:documentation source="AdditionalRequirements">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>
1318                            </xsd:annotation>
1319                        </xsd:element>
1320                        <xsd:element name="L00_Heading" minOccurs="0">
1321                            <xsd:annotation>
1322                                <xsd:documentation source="FieldText">
1323                                    <d:b> Heating Equipment</d:b>
1324                                </xsd:documentation>
1325                            </xsd:annotation>
1326                        </xsd:element>
1327                        <xsd:element name="L01" minOccurs="0">
1328                            <xsd:annotation>
1329                                <xsd:documentation source="FieldText">Equipment Efficiency</xsd:documentation>
1330                                <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>
1331                            </xsd:annotation>
1332                        </xsd:element>
1333                        <xsd:element name="L02" minOccurs="0">
1334                            <xsd:annotation>
1335                                <xsd:documentation source="FieldText">Controls</xsd:documentation>
1336                                <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>
1337                            </xsd:annotation>
1338                        </xsd:element>
1339                        <xsd:element name="L03" minOccurs="0">
1340                            <xsd:annotation>
1341                                <xsd:documentation source="FieldText">Sizing:</xsd:documentation>
1342                                <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 and 2).</xsd:documentation>
1343                            </xsd:annotation>
1344                        </xsd:element>
1345                        <xsd:element name="L04" minOccurs="0">
1346                            <xsd:annotation>
1347                                <xsd:documentation source="FieldText">Furnace Temperature Rise</xsd:documentation>
1348                                <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>
1349                            </xsd:annotation>
1350                        </xsd:element>
```



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1351                        <xsd:element name="L05" minOccurs="0">
1352                            <xsd:annotation>
1353                                <xsd:documentation source="FieldText">Standby Losses and Pilot
      Lights</xsd:documentation>
1354                                <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>
1355                            </xsd:annotation>
1356                        </xsd:element>
1357                        <xsd:element name="L05After_Heading" minOccurs="0">
1358                            <xsd:annotation>
1359                                <xsd:documentation source="FieldText">
1360                                    <d:b> Cooling Equipment</d:b>
1361                                </xsd:documentation>
1362                            </xsd:annotation>
1363                        </xsd:element>
1364                        <xsd:element name="L06" minOccurs="0">
1365                            <xsd:annotation>
1366                                <xsd:documentation source="FieldText">Equipment
      Efficiency:</xsd:documentation>
1367                                <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>
1368                            </xsd:annotation>
1369                        </xsd:element>
1370                        <xsd:element name="L07" minOccurs="0">
1371                            <xsd:annotation>
1372                                <xsd:documentation source="FieldText">Refrigerant Line
      Insulation</xsd:documentation>
1373                                <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>
1374                            </xsd:annotation>
1375                        </xsd:element>
1376                        <xsd:element name="L08" minOccurs="0">
1377                            <xsd:annotation>
1378                                <xsd:documentation source="FieldText">Condensing Unit
      Location</xsd:documentation>
1379                                <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>
1380                            </xsd:annotation>
1381                        </xsd:element>
1382                        <xsd:element name="L09" minOccurs="0">
1383                            <xsd:annotation>
1384                                <xsd:documentation source="FieldText">Liquid Line Filter
      Drier</xsd:documentation>
1385                                <xsd:documentation source="AdditionalRequirements">Liquid Line Filter
      Drier: A  liquid line filter drier shall be installed according to the manufacturer's specifications
      150.0(h)3B</xsd:documentation>
1386                            </xsd:annotation>
1387                        </xsd:element>
1388                        <xsd:element name="L10" minOccurs="0">
1389                            <xsd:annotation>
1390                                <xsd:documentation source="FieldText">Sizing</xsd:documentation>
1391                                <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>
1392                            </xsd:annotation>
1393                        </xsd:element>
1394                        <xsd:element name="L10After_Heading" minOccurs="0">
1395                            <xsd:annotation>
1396                                <xsd:documentation source="FieldText">
1397                                    <d:b> Air Distribution System Ducts, Plenums and Fans</d:b>
1398                                </xsd:documentation>
```

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1399                            </xsd:annotation>
1400                        </xsd:element>
1401                        <xsd:element name="L11" minOccurs="0">
1402                            <xsd:annotation>
1403                                <xsd:documentation source="FieldText">Insulation</xsd:documentation>
1404                                <xsd:documentation source="AdditionalRequirements">Insulation: 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>
1405                            </xsd:annotation>
1406                        </xsd:element>
1407                        <xsd:element name="L12" minOccurs="0">
1408                            <xsd:annotation>
1409                                <xsd:documentation source="FieldText">Connections and
    Closures</xsd:documentation>
1410                                <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
    otherwise a minimum of R4.2 is allowed if the system is enclosed entirely in conditioned space as
    confirmed through field verification and diagnostic testing in accordance with the requirements of
    Reference Residential Appendix RA3.1.4.3.8.  Exceptions for ducts in interior wall cavities or exposed
    ducts entirely in conditioned space are specified in Section 150.0(m)1B.</xsd:documentation>
1411                            </xsd:annotation>
1412                        </xsd:element>
1413                        <xsd:element name="L12After_Heading" minOccurs="0">
1414                            <xsd:annotation>
1415                                <xsd:documentation source="FieldText">
1416                                    <d:b> Heat Pump Thermostat</d:b>
1417                                </xsd:documentation>
1418                            </xsd:annotation>
1419                        </xsd:element>
1420                        <xsd:element name="L13" minOccurs="0">
1421                            <xsd:annotation>
1422                                <xsd:documentation source="FieldText">Requirements of Section 110.2(b)
    and (c)</xsd:documentation>
1423                                <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>
1424                            </xsd:annotation>
1425                        </xsd:element>
1426                        <xsd:element name="L14" minOccurs="0">
1427                            <xsd:annotation>
1428                                <xsd:documentation source="FieldText">Manufacturers published
    installation specifications</xsd:documentation>
1429                                <xsd:documentation source="AdditionalRequirements">The thermostat
    shall be installed in accordance with the manufacturers published installation
    specifications</xsd:documentation>
1430                            </xsd:annotation>
1431                        </xsd:element>
1432                        <xsd:element name="L15" minOccurs="0">
1433                            <xsd:annotation>
1434                                <xsd:documentation source="FieldText">First stage of
    heating</xsd:documentation>
1435                                <xsd:documentation source="AdditionalRequirements">First stage of
    heating shall be assigned to heat pump heating.</xsd:documentation>
1436                            </xsd:annotation>
1437                        </xsd:element>
1438                        <xsd:element name="L16" minOccurs="0">
1439                            <xsd:annotation>
1440                                <xsd:documentation source="FieldText">Second stage back up
    heating</xsd:documentation>
1441                                <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>
1442                            </xsd:annotation>
1443                        </xsd:element>
1444                        <xsd:element name="LEndNote1" minOccurs="0">
```

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                            <xsd:annotation>
                                <xsd:documentation source="FieldText">End Note 1</xsd:documentation>
                                <xsd:documentation source="AdditionalRequirements">The responsible person's 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="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 20190501"/>
            <xsd:attribute name="doc" type="comp:ComplianceDocumentTag" use="required" fixed="CF2RMCH01bE"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name="cF2RMCH01bE" type="CF2RMCH01bE">
        <xsd:annotation>
            <xsd:documentation>This element contains all of the data and text required to generate the CF2RMCH01bE compliance report.</xsd:documentation>
        </xsd:annotation>
    </xsd:element>
</xsd:schema>
```

