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ECC Application – R3
Proof of Self-Testing

Public Document

Docket 25-BSTD-01 — 2025 Energy Code Compliance Provider Applications

Date: November 15th , 2025

Exhibit R3 — Proof of Self-Testing

Golden State Registry (GSR)
Residential Data Registry Application
Docket 25-BSTD-01
2025 Code Cycle

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1. Purpose of This Exhibit

This document is submitted as Exhibit R3 in support of Golden State Registry's ("GSR") application for approval as a Residential Data Registry under the 2025 Energy Code Compliance (ECC) program.

Exhibit R3 documents the completion of required registry self-testing prior to Commission approval and supplements:

- **Exhibit R — Registry Application**
  (addressing CEC Application Checklist sections R1 and R2)
- **Exhibit R1 — Scope of Registry**
- **Exhibit R2 — Compliance Cross-Reference Checklist**
- Registered self-test sample projects submitted to the California Energy Commission.

This exhibit provides structured documentation of:

- The compliance scenarios exercised during self-testing,
- The document types and pathway variations tested,
- The registered proof files submitted,
- The functional registry controls validated, and
- The availability of live system access for Commission acceptance testing.

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2. Regulatory Basis for Self-Testing

Self-testing is required under:

- **Joint Appendix JA7.8 — Data Registry Approval Requirements**
- **JA7.8.2.2 — Compliance Document Registration Self-Testing Results**
- **Title 24, Part 1, Section 10-109**
- **Data Registry Requirements Manual (DRRM)**

These provisions require registry applicants to:

1. Demonstrate that all supported compliance document types can be:
    - Created,
    - Validated,
    - Signed,
    - Registered,
    - Secured with digital signatures,
    - Stored as flat, non-editable PDF images, and
    - Retrieved by authorized users;
2. Provide registered sample documents for Commission review; and
3. Provide registry access credentials for acceptance testing.

Golden State Registry affirms that self-testing has been completed for all document types and compliance pathway variations within the approved scope defined in **Exhibit R1 — Scope of Registry.**

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3. Scope of Self-Testing

The approved registry scope for this application, as defined in Exhibit R1, is:

Prescriptive compliance of single-family residential space conditioning system alterations.

Under the 2025 ECC registry structure, multiple compliance scenarios are consolidated into unified CF1R, CF2R, and CF3R form structures.

Although fewer discrete forms exist compared to prior code cycles, the 2025 consolidated forms contain multiple embedded compliance pathway variations. Self-testing therefore included:

- Each supported document type (CF1R, CF2R, CF3R),
- Each major compliance scenario within scope,
- Alternate compliance methods (e.g., refrigerant charge calculation methods),
- Failure and retest workflows,
- Revision increment logic,
- Parent/child document orphan handling,
- Signature sequencing enforcement,
- Registration number formatting and structure,
- Timestamp generation (YYYY-MM-DD HH:MM:SS, 24-hour format),
- Provider digital signature application,
- Flat PDF image generation and storage,
- Public key validation using standard PDF reader software,
- Role-based access enforcement, and
- Project Status Report (PSR) functionality.

All self-testing was performed within the live Golden State Registry production environment used for normal registry operations.

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4. Self-Testing Methodology

Self-testing was conducted within the live Golden State Registry production environment prior to submission of this application. All testing activities were performed using the same validation logic, system integrations, CEC Report Generator interface, and digital signature infrastructure that will be used for operational registry services upon approval.

Self-testing simulated complete, end-to-end prescriptive HVAC alteration projects within the approved scope defined in Exhibit R1 — Scope of Registry.

The methodology reflects the actual system architecture described in the Registry Application and includes the following stages:

4.1 Project Creation and Data Entry Validation (GSR Front-End Controls)

Test projects were created within the GSR Registry interface representing compliant prescriptive HVAC alteration scenarios.

GSR's software performs all front-end validation prior to document generation. Self-testing verified:

- Required-field enforcement,
- Optional field null handling,
- Schema validation against CEC XML specifications,
- Logic checks and dependency triggers (e.g., CF3R requirements),
- Calculation routines (airflow, fan efficacy, refrigerant charge, duct leakage thresholds),
- Lookup-equivalent validation against RA3 standards tables,
- Error messaging and correction enforcement prior to signature enablement.

Documents intentionally included both compliant and non-compliant data entries to confirm that invalid entries blocked further processing.

No document could proceed to generation until all validation gates passed.

4.2 Transmission to CEC Report Generator and Official PDF Creation

Once front-end validation was satisfied, compliance data packages were transmitted securely to the **CEC Report Generator**, consistent with the architecture described in Exhibit R — Registry Application.

Self-testing confirmed:

- Secure transmission of validated compliance data,
- Proper receipt and processing by the CEC Report Generator,
- Generation of official CEC-approved CF1R, CF2R, and CF3R document layouts,
- Conformance to fixed coordinate positions for data fields and signature blocks,
- Accurate rendering of all entered and calculated values in the generated PDF output.

The CEC Report Generator produces the base, flat, non-editable PDF document reflecting official CEC template formatting. The CEC Report Generator produces the official CEC-approved document templates; GSR does not alter the substantive content or layout of those templates.

4.3 Registration Event and Signature Application (Post-Generation Controls)

After the CEC Report Generator returned the finalized PDF document:

GSR performed the registration event and applied required registry controls, including:

- Sequential enforcement of Documentation Author signature,
- Sequential enforcement of Registration Signer signature,
- Multi-factor authentication for signature-capable accounts,
- Visible signature block rendering (name, credentials, timestamp),
- Automatic generation of standardized registration number,
- Registration number placement in the footer of each document page,
- Timestamp formatting (YYYY-MM-DD HH:MM:SS, 24-hour format),
- Application of GSR's provider digital signature using SSLcom-issued certificates,
- Provider watermark/logo placement,
- Hash generation and asymmetric encryption binding the final PDF.

Only after this stage was the document considered officially registered.

4.4 Flat PDF Locking and Tamper Protection

Upon completion of the registration event:

- The final PDF was cryptographically locked.
- A flat, non-editable PDF image was stored.
- Subsequent viewing or downloading returns the identical stored image (no re-rendering).
- Any alteration attempt invalidates the digital signature.
- Hash validation ensures content integrity.
- The digital certificate chain is attached and verifiable in common PDF reader software.

Self-testing included validation of digital signature authenticity using standard PDF readers.

4.5 Revision, Parent/Child, and Orphan Logic Testing

Self-testing also exercised lifecycle controls described in Exhibit R1-D

- Revision digit increment upon correction or superseding,
- Parent/child document linkage across CF1R, CF2R, CF3R,
- Automatic orphaning of dependent CF3R documents when parent revisions occur,
- Required re-signature enforcement,
- Project Status Report (PSR) update logic.

4.6 Access, Retrieval, and Oversight Verification

Testing confirmed:

- Role-based access control (RBAC) enforcement,
- View-only account functionality,
- PSR generation and QR routing logic,
- In-browser document viewing,
- Secure PDF download,
- Digital signature validation using GSR's published public key,
- Secure transmission and encrypted retention.

CEC staff were provided access credentials to independently verify these controls in the live registry environment.

4.7 Confirmation of End-to-End Operational Integrity

Through this structured process, GSR validated the complete operational chain:

Front-End Validation →
Secure Transmission →
CEC Report Generator PDF Creation →
Signature Application →
Registration Numbering →
Digital Signature Binding →
Flat PDF Storage →
Access & Oversight Verification.

Golden State Registry affirms that all required registry controls under JA7.4 through JA7.7 have been exercised and validated within this full system architecture prior to submission.

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5. Self-Testing Pathway Crosswalk

Introductory Clarification for Section 5-1

Due to the consolidated document structure adopted under the 2025 Energy Code Compliance (ECC) program, multiple prescriptive compliance scenarios are embedded within unified CF2R and CF3R form templates rather than being issued as separate standalone forms. Accordingly, the compliance pathways identified below represent variations and conditional branches within the scope of the following approved document types:

Document Number	Document Type	Document Description
CF1R-ALT-02-E	Prescriptive Certificate of Compliance	HVAC Alterations
CF2R-MCH-01b-E	Certificate of Installation	HVAC Systems, Ducts and Fans for Prescriptive Alterations
CF2R-MCH-20-H	Certificate of Installation	Duct Leakage Diagnostic Test
CF2R-MCH-22-H	Certificate of Installation	Space Conditioning System Fan Efficacy
CF2R-MCH-23-H	Certificate of Installation	Space Conditioning System Airflow Rate
CF2R-MCH-25-H	Certificate of Installation	Refrigerant Charge Verification
CF2R-MCH-28-H	Certificate of Installation	Return Duct Design and Air Filter Device Sizing

		According to Tables 150 B or C
CF3R-MCH-20-H	Certificate of Installation	Duct Leakage Diagnostic Test
CF3R-MCH-22-H	Certificate of Installation	Space Conditioning System Fan Efficacy
CF3R-MCH-23-H	Certificate of Installation	Space Conditioning System Airflow Rate
CF3R-MCH-25-H	Certificate of Installation	Refrigerant Charge Verification
CF3R-MCH-28-H	Certificate of Installation	Return Duct Design and Air Filter Device Sizing According to Tables 150 B or C

The pathways listed in Table 5-1 demonstrate that each applicable variation within these consolidated forms has been exercised, validated, transmitted to the CEC Report Generator, signed, registered, and digitally sealed in accordance with the operational workflow described in Section 4. As such, the scenarios below confirm the functional viability of the full prescriptive alteration framework under the 2025 ECC form structure.

Table 5-1 — Self-Testing Pathway Verification Matrix

The following table identifies each compliance scenario exercised during registry self-testing within the approved scope defined in Exhibit R1 — Scope of Registry.

Each pathway listed below represents a complete prescriptive alteration packet processed through:

- GSR front-end validation,
- Secure transmission to the CEC Report Generator,
- Official CF1R / CF2R / CF3R PDF generation,
- Required electronic signature sequencing,
- Application of GSR watermark,
- Registration number and timestamp assignment,
- Provider digital signature application,
- Flat, non-editable PDF storage.

Line	Compliance Scenario Description	Forms Exercised	Proof File Submitted
Line A	Alteration to refrigerant containing component — mini-split or packaged AC	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered CF2R/CF3R forms	Line A-signed
Line B	Changeout mini-split system component	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line B-signed
Line C	New ducted hydronic fan coil unit or furnace	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line C-signed
Line D	New furnace + duct alteration	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-20 + triggered CF3R	Line D-signed
Line E	Alteration to refrigerant containing component — split system	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line E-signed
Line F	Changeout refrigerant containing components	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line F-signed
Line G	Changeout refrigerant containing component + altered ducts	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-20 + triggered CF3R	Line G-signed
Line H	Alteration to refrigerant containing component + altered ducts	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-20 + triggered CF3R	Line H-signed
Line I	New duct system without equipment changeout	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-20	Line I-signed
Line J	New furnace + new duct system (system has cooling installed)	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-20 + triggered CF3R	Line J-signed
Line K	Alteration to refrigerant containing component + new duct system	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line K-signed
Line L	Changeout refrigerant containing component + new duct system	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line L-signed
Line M	Entirely new ductless hydronic heating system (boiler heating only); or new wall heater	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line M-signed
Line N	New mini-split (weigh-in); or new room packaged AC (factory charged)	CF1R-ALT-02-E + CF2R-MCH-01b-E + MCH-25 + CF3R-MCH-25	Line N-signed
Line O	New ducted hydronic heating system, or other new ducted heating-only system	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line O-signed
Line P	New split system	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line P-signed
Line Q	Altered ducts	CF1R-ALT-02-E + CF2R-MCH-20-H + CF3R-MCH-20-H	Line Q-signed
Line R	No alteration performed	CF1R-ALT-02-E	Line R-signed
Line S	No alteration performed	CF1R-ALT-02-E	Line S-signed
Line T	New ducted system with less than 25 ft of ducts	CF1R-ALT-02-E + CF2R-MCH-20-H	Line T-signed
Line U	New ducted hydronic fan coil unit or new hydronic heating boiler	CF1R-ALT-02-E + CF2R-MCH-01b-E + triggered forms	Line U-signed

Footnote:
Beyond the scenarios listed in Table 5-1, GSR tested additional embedded pathway variations within the consolidated 2025 forms, including conditional logic branches, multi-system

configurations, climate zone variations, alternate calculation methods, and dependent CF3R verification triggers. All variations were exercised through the complete validation, Report Generator, signature, and registration workflow described in Section 4.

Clarification Regarding Consolidated 2025 Form Structure

Each pathway listed above represents a complete compliance packet, including all required dependent CF2R and CF3R documents triggered by the selected compliance scenario.

Although the 2025 ECC framework consolidates multiple compliance pathways into unified CF2R and CF3R templates, self-testing exercised:

- All conditional logic branches,
- All triggered diagnostic measures,
- All required CF3R verification dependencies,
- Signature sequencing (Documentation Author → Registration Signer → ECC Rater where applicable),
- Registration numbering and revision logic,
- Digital signature binding, required watermark, and flat PDF storage.

Accordingly, each Line A–U scenario reflects a full lifecycle compliance test consistent with the operational architecture described in Exhibit R — Registry Application

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6. Self-Testing Completion Statement

Golden State Registry affirms that self-testing has been completed for all document types and compliance pathways within the approved scope defined in Exhibit R1 — Scope of Registry.

Each pathway identified in Section 5 was processed through the complete operational lifecycle described in Exhibit R — Registry Application, including:

- Front-end validation within the GSR Registry,
- Secure transmission to the CEC Report Generator,
- Official CF1R, CF2R, and CF3R document generation,
- Required electronic signature sequencing,
- Application of GSR watermark
- Registration number and timestamp assignment,
- Provider digital signature application,
- Flat, non-editable PDF locking and encrypted storage.

Registered sample projects corresponding to each tested pathway have been submitted to the California Energy Commission and remain available within the live registry environment for acceptance testing and independent verification.

Golden State Registry respectfully submits that the completion of these self-testing procedures demonstrates full operational readiness of the Residential Data Registry within the defined prescriptive scope.

