

BUILDING LEAKAGE DIAGNOSTIC TEST

CEC-CF3R-ENV-20-H (Revised 09/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		CF3R-ENV-20-H
Building Leakage Diagnostic Test		(Page 1 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

A. Building Air Leakage – General Information

01	Test Procedure Used	
02	Building Air Leakage Target from CF1R	
03	Indoor Temperature During Test (°F)	
04	Outdoor Temperature During Test (°F)	
05	Blower Door Location	
06	Building Elevation (ft)	
07	Building Volume (ft ³)	
08	Date of the Diagnostic Test for this Dwelling	

B. Diagnostic Equipment Information

01	Number of Manometers Used to Measure Home Pressurization			
02	03	04	05	06
Manometer Make	Manometer Model	Manometer Serial Number	Manometer Calibration Date	Manometer Calibration Status
07	Number of Fans Used to Pressurize Home			
08	09	10	11	
Fan Make	Fan Model	Fan Serial Number	Fan Configuration (rings)	

ENV20b - Single Point Air Tightness Test With Automatic Meter**C. Envelope Leakage Diagnostic Test**

01	Time Average Period of Meter	
02	Baseline Building Pressure Reading #1	
03	Baseline Building Pressure Reading #2	
04	Baseline Building Pressure Reading #3	
05	Baseline Building Pressure Reading #4	
06	Baseline Building Pressure Reading #5	
07	Baseline Range	
08	Accuracy Level	
09	Average Baseline Building Pressure Reading (Pa)	
10	Pre-Test Baseline Building Pressure (Pa)	
11	Induced Building Pressure from Manometer (Pa)	
12	Induced Building Pressure Check	
13	Nominal CFM50	

D. Altitude and Temperature Correction

01	Altitude Correction Factor	
02	Temperature Correction Factor	
03	Corrected CFM50	

E. Accuracy Adjustment

01	Accuracy Adjustment Factor	
02	Adjusted CFM50 (measured air leakage rate)	

BUILDING LEAKAGE DIAGNOSTIC TEST

CEC-CF3R-ENV-20-H (Revised 09/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		CF3R-ENV-20-H
Building Leakage Diagnostic Test		(Page 2 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

F. Compliance Statement

01	
----	--

G. Additional Requirements for Compliance

01	Open all interior doors and access including those to closets and those between a conditioned basement and attic.	
02	HVAC Supply and return register dampers shall be fully open.	
03	Temporarily sealing of combustion flues and intermittent exhaust fans are not allowed. Some examples are: combustion flues, fresh air intakes, dryer vents, bathroom and kitchen exhaust vents and fire place.	
04	Continuously operated ventilation devices like energy recovery ventilators may be sealed.	
05	Multifamily – Each dwelling unit must be tested individually and shown to meet the leakage requirements. Pressurization of the adjacent dwelling units while conducting this test is not allowed.	
06	Verification Status:	<input type="checkbox"/> <u>Pass</u> - all applicable requirements are met; or <input type="checkbox"/> <u>Fail</u> - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or <input type="checkbox"/> <u>All N/A</u> - This entire table is not applicable
07	Correction Notes:	

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

H. Determination of HERS Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

01	
----	--

BUILDING LEAKAGE DIAGNOSTIC TEST

CEC-CF3R-ENV-20-H (Revised 09/16)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		CF3R-ENV-20-H
Building Leakage Diagnostic Test		(Page 3 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Verification documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Date Signed:
Address:	CEA/HERS Certification Information (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:	
<ol style="list-style-type: none"> The information provided on this Certificate of Verification is true and correct. I am the certified HERS Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater). The installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification identified on this Certificate of Verification comply with the applicable requirements in Reference Appendices RA2, RA3, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency. The information reported on applicable sections of the Certificate(s) of Installation (CF2R) signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (CF1R) approved by the enforcement agency. I will ensure that a registered copy of this Certificate of Verification 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 Verification is required to be included with the documentation the builder provides to the building owner at occupancy. 	
BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION	
Company Name (Installing Subcontractor, General Contractor, or Builder/Owner):	
Responsible Builder or Installer Name:	CSLB License:
HERS PROVIDER DATA REGISTRY INFORMATION	
Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable):
HERS RATER INFORMATION	
HERS Rater Company Name:	
Responsible Rater Name:	Responsible Rater Signature:
Responsible Rater Certification Number w/ this HERS Provider:	Date Signed:

CF3R-ENV20b-H User Instructions**Section A. Building Air Leakage – General Information**

1. Select the appropriate test procedure. This selection will determine which version of this document will be used (a, b, c, d, or e) and therefore which data must be collected. Note that single-point tests can only be used under certain conditions. Note that newer manometers have automatic functions for compensating for baseline (automatic baseline) and compensating for house pressures other than the target (@50 Pa). It is preferable to use these, when available, however if these automatic functions are to be used, they must be used for BOTH automatic baseline and pressure compensation.
2. This number is automatically pulled from the CF1R and is the target maximum that was entered by the documentation author. If this number cannot be achieved, the performance compliance calculations can be redone with a higher number or without the requirement for building air leakage.
3. Enter the indoor temperature measured at the time that the building air leakage test was performed.
4. Enter the outdoor temperature measured at the time that the building air leakage test was performed.
5. Provide a brief description of the location where the blower door was installed for the test. Examples: "front entry door on west side of house", "door between house and garage", "large window in family room".
6. Enter the building elevation; use the value for the closest city found in Joint Appendix JA2.2. Only elevations higher than 5,000 feet require an adjustment to the calculations.
7. This number is automatically pulled from the CF1R. It is used to calculate air changes.
8. Enter the date that the building leakage test data was collected.

Section B. Diagnostic Equipment Information

1. Enter the number of manometers used to measure the home pressurization. If more than one system is used, the fan flow numbers need to be manually added together, unless blower door software is used that will accommodate multiple fan systems running simultaneously.
2. Enter the make (brand) of the manometer used to collect the building air leakage data. Examples: Retrotec, Energy Conservatory.
3. Enter the model of the manometer used to collect the building air leakage data. Examples: DM-2 Mark II, DG700.
4. Enter the serial number of the manometer used to collect the building air leakage data.
5. Enter the most recent date that the manometer was calibrated by following manufacturer's calibration specifications.
6. This field is automatically filled. If the calibration date was more than 12 months prior to the test date entered in A08, above, an error will appear.
7. Enter the number of blower door fan systems required to run simultaneously to pressurize the home for the building air leakage test. If more than one system is used, the fan flow numbers need to be manually added together, unless blower door software is used that will accommodate multiple fan systems running simultaneously.
8. Enter the make (brand) of the fan used to collect the building air leakage data. Examples: Retrotec, Energy Conservatory.
9. Enter the model of the fan used to collect the building air leakage data. Examples: US1000, Q46, BD3, BD4.
10. Enter the serial number of the fan used to collect the building air leakage data.
11. Enter the fan configuration shown on the meter. This is sometimes referred to as "range configuration", "CONFIG" or "rings". Examples: Open, A, B, C8.

Section C. Envelope Leakage Test (ENV20b)

1. Enter the Time Average Period used on the manometer during the test. Must be at least 10 seconds.
2. Enter the first of five baseline building pressure readings (Resolution of 0.1 Pa).
3. Enter the second of five baseline building pressure readings (Resolution of 0.1 Pa).
4. Enter the third of five baseline building pressure readings (Resolution of 0.1 Pa).
5. Enter the fourth of five baseline building pressure readings (Resolution of 0.1 Pa).
6. Enter the fifth of five baseline building pressure readings (Resolution of 0.1 Pa).
7. This field is automatically calculated. The Baseline Range is the largest value of the five baseline readings minus the smallest value of the five baseline readings.
8. This field is automatically calculated. "Standard" is when the baseline range is less than 5 Pa; "Reduced" is when the baseline range is between 5 and 10 Pa (inclusive). If the baseline range is greater than 10 you must use a multi-point procedure.
9. This field is automatically calculated. Average Baseline Building Pressure Reading is simply the average of the five baseline readings.
10. Enter the Pre-Test Baseline Building Pressure. The protocols allow the average to be used or a newly measured number can be used.
11. Enter the Induced Building Pressure straight from the manometer.
12. This field is automatically calculated. A check is performed to make sure that a pressure of at least -15 pa was achieved. If not, the Single Point Test may not be used.
13. Enter the Nominal CFM50 fan flow from the manometer. The meter should be set to automatically adjust to -50 Pa (@50 setting).

Section D. Altitude and Temperature Correction

1. This field is automatically calculated. The equation used to calculate this value in the field equals:
 - a. If the elevation is less than or equal to 5,000 ft, the Altitude Correction Factor is 1 (no adjustment).

- b. If the elevation is greater than 5,000 ft, the Altitude Correction equation equals $1 + (0.000006 * \text{elevation in feet})$
- 2. Enter the Temperature Correction Factor from Table RA3.8-2 or RA3.8-3 using the indoor and outdoor temperatures entered in Section A.

Table RA3.8-2 Temperature Correction Factors for Depressurization Testing- Calculated according to ASTM E779-10

Outside Temp (F)	Inside Temperature (F)									
	50	55	60	65	70	75	80	85	90	
-20	1.062	1.072	1.081	1.090	1.099	1.108	1.117	1.127	1.136	
-15	1.056	1.066	1.075	1.084	1.093	1.102	1.111	1.120	1.129	
-10	1.051	1.060	1.069	1.078	1.087	1.096	1.105	1.114	1.123	
-5	1.045	1.054	1.063	1.072	1.081	1.090	1.099	1.108	1.117	
0	1.039	1.048	1.057	1.066	1.075	1.084	1.093	1.102	1.111	
5	1.033	1.042	1.051	1.060	1.069	1.078	1.087	1.096	1.105	
10	1.028	1.037	1.046	1.055	1.064	1.072	1.081	1.090	1.099	
15	1.023	1.031	1.040	1.049	1.058	1.067	1.076	1.084	1.093	
20	1.017	1.026	1.035	1.044	1.052	1.061	1.070	1.079	1.087	
25	1.012	1.021	1.029	1.038	1.047	1.056	1.064	1.073	1.082	
30	1.007	1.015	1.024	1.033	1.041	1.050	1.059	1.067	1.076	
35	1.002	1.010	1.019	1.028	1.036	1.045	1.054	1.062	1.071	
40	0.997	1.005	1.014	1.023	1.031	1.040	1.048	1.057	1.065	
45	0.992	1.000	1.009	1.017	1.026	1.035	1.043	1.051	1.060	
50	0.987	0.995	1.004	1.012	1.021	1.029	1.038	1.046	1.055	
55	0.982	0.990	0.999	1.008	1.016	1.024	1.033	1.041	1.050	
60	0.997	0.986	0.994	1.003	1.011	1.019	1.028	1.036	1.045	
65	0.973	0.981	0.989	0.998	1.006	1.015	1.023	1.031	1.040	
70	0.968	0.976	0.985	0.993	1.001	1.010	1.018	1.026	1.035	
75	0.963	0.972	0.980	0.988	0.997	1.005	1.013	1.022	1.030	
80	0.959	0.967	0.976	0.984	0.992	1.000	1.009	1.017	1.025	
85	0.955	0.963	0.971	0.979	0.988	0.996	1.004	1.012	1.020	
90	0.950	0.958	0.967	0.975	0.983	0.991	0.999	1.008	1.016	
95	0.946	0.954	0.962	0.970	0.979	0.987	0.995	1.003	1.011	
100	0.942	0.950	0.958	0.966	0.970	0.982	0.990	0.998	1.007	
105	0.938	0.946	0.954	0.962	0.970	0.978	0.986	0.994	1.002	
110	0.933	0.942	0.950	0.952	0.966	0.974	0.982	0.990	0.998	

For information only. Not valid until HERS provided

Table RA3.8-3 Temperature Correction Factors for Pressurization Testing- Calculated according to ASTM E779-10

Outside Temp (F)	Inside Temperature (F)									
	50	55	60	65	70	75	80	85	90	
-20	0.865	0.861	0.857	0.853	0.849	0.845	0.841	0.837	0.833	
-15	0.874	0.870	0.866	0.862	0.858	0.854	0.850	0.846	0.842	
-10	0.883	0.879	0.874	0.870	0.866	0.862	0.858	0.854	0.850	
-5	0.892	0.887	0.883	0.879	0.875	0.871	0.867	0.863	0.859	
0	0.900	0.896	0.892	0.887	0.883	0.879	0.875	0.871	0.867	
5	0.909	0.905	0.900	0.896	0.892	0.888	0.883	0.879	0.875	
10	0.918	0.913	0.909	0.905	0.900	0.896	0.892	0.888	0.884	
15	0.927	0.922	0.918	0.913	0.909	0.905	0.900	0.896	0.892	
20	0.935	0.931	0.926	0.922	0.917	0.913	0.909	0.905	0.900	
25	0.944	0.939	0.935	0.930	0.926	0.922	0.917	0.913	0.909	
30	0.952	0.948	0.943	0.939	0.934	0.930	0.926	0.921	0.917	
35	0.961	0.956	0.952	0.947	0.943	0.938	0.934	0.930	0.926	
40	0.970	0.965	0.960	0.956	0.951	0.947	0.942	0.938	0.934	
45	0.978	0.974	0.969	0.964	0.960	0.955	0.951	0.946	0.942	
50	0.987	0.982	0.977	0.973	0.968	0.963	0.959	0.955	0.950	
55	0.995	0.990	0.986	0.981	0.976	0.972	0.967	0.963	0.958	
60	1.004	0.999	0.994	0.998	0.985	0.980	0.976	0.971	0.967	
65	1.012	1.008	1.003	0.998	0.993	0.988	0.984	0.979	0.975	
70	1.021	1.016	1.011	1.006	1.001	0.997	0.992	0.988	0.983	
75	1.029	1.024	1.019	1.015	1.010	1.005	1.000	0.996	0.991	
80	1.038	1.033	1.028	1.023	1.018	1.013	1.009	1.004	0.999	
85	1.046	1.041	1.036	1.031	1.026	1.022	1.017	1.012	1.008	
90	1.055	1.050	1.045	1.040	1.035	1.030	1.025	1.020	1.016	
95	1.063	1.058	1.053	1.048	1.043	1.038	1.033	1.028	1.024	
100	1.072	1.066	1.061	1.056	1.051	1.046	1.041	1.037	1.032	
105	1.080	1.075	1.070	1.064	1.059	1.054	1.050	1.045	1.040	
110	1.088	1.083	1.078	1.073	1.068	1.063	1.058	1.053	1.048	

- This field is automatically calculated. The Corrected CFM50 is the Nominal CFM50 from Section C multiplied by the Altitude and Temperature Correction Factors.

Section E. Accuracy Adjustment

- This field is automatically calculated:
 - If the Accuracy Level from Section C is "Standard", the Accuracy Adjustment will be 1 (no adjustment)
 - If the Accuracy Level from Section C is "Reduced", Accuracy Adjustment equation equals $1 + [0.1 + (50 / \text{Nominal CFM50})]$
- This field is automatically calculated. The Adjusted CFM50 is the Corrected CFM50 multiplied by the Accuracy Adjustment. Note - This is the number that must be less than or equal to the target building air leakage from the CF1R, shown in A02.

Section F. Compliance Statement

- This field is automatically calculated. A check is performed to make sure that the meter has been properly calibrated and that the measured infiltration is less than the target infiltration.

Section G. Additional Requirements for Compliance

- This statement must be true (or not applicable) for the test to conform to the protocols.
- This statement must be true (or not applicable) for the test to conform to the protocols.
- This statement must be true (or not applicable) for the test to conform to the protocols.
- This statement must be true (or not applicable) for the test to conform to the protocols.
- This statement must be true (or not applicable) for the test to conform to the protocols.
- Verification Status:** If this Section does not apply, then select "All n/a". If the home meets all of the additional requirements for compliance then select "Pass", otherwise select "Fail". The latter selection means that the home does not meet the requirements and the home will need to be modified to meet the requirements.
- Correction Notes:** If one or more applicable requirements are not met "Fail" will appear in the row above. When this occurs the rater is required to enter detailed notes here that describe what failed and why.

Section H. Determination of HERS Verification Compliance

- This field is filled out automatically. Compliance requires that all individual criteria pass.