



CERTIFICATE OF INSTALLATION		CF3R-MCH-24-H
Building Leakage Worksheet		(Page 1 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Dwelling Address:	City:	Zip Code:

A. Building Air Leakage – General Information

01	Indoor Temperature During Test (degreeF)	
02	Outdoor Temperature During Test (degreeF)	
03	Blower Door Location	
04	Building Elevation (ft)	
05	Building Volume (ft ³)	
06	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)	

C. Envelope Leakage Worksheet - Depressurization - MCH24e - Repeated Single Point Air Tightness Test With Automatic Meter

01	Time Average Period of Meter	
02	Blower Door Software Used for Calculations?	
	03	04
	Induced Building Pressure	Nominal CFM50
05	Average Nominal CFM50	

D. Altitude and Temperature Correction

01	Altitude Correction Factor	
02	Temperature Correction Factor	
03	Corrected CFM50	

E. Accuracy Adjustment

01	Standard Deviation of Nominal CFM 50 Values Above	
02	Percent Uncertainty	
03	Accuracy Level	
04	Accuracy Adjustment Factor	
05	Adjusted CFM50 Depressurization (measured air leakage rate)	
06	Corrected CFM50 (from software)	
07	Percent Uncertainty @ 95% Confidence Level (from software)	

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2016 Residential Compliance

<Date>



CERTIFICATE OF INSTALLATION		CF3R-MCH-24-H
Building Leakage Worksheet		(Page 2 of 3)
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F. Envelope Leakage Worksheet – Pressurization - MCH24e – Repeated Single Point Air Tightness Test With Automatic Meter

01	Time Average Period of Meter	
02	Blower Door Software Used for Calculations?	
	03	04
	Induced Building Pressure	Nominal CFM50
05	Average Nominal CFM50	

G. Altitude and Temperature Correction

01	Altitude Correction Factor	
02	Temperature Correction Factor	
03	Corrected CFM50	

H. Accuracy Adjustment

01	Standard Deviation of Nominal CFM 50 Values Above	
02	Percent Uncertainty	
03	Accuracy Level	
04	Accuracy Adjustment Factor	
05	Adjusted CFM50 Pressurization (measured air leakage rate)	
06	Corrected CFM50 (from software)	
07	Percent Uncertainty @ 95% Confidence Level (from software)	

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

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2016 Residential Compliance

<Date>

BUILDING LEAKAGE WORKSHEET

CEC-CF3R-MCH-24-H (Revised MM/YY)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF INSTALLATION		CF3R-MCH-24-H
Building Leakage Worksheet		(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:

- 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):
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HERS RATER INFORMATION

HERS Rater Company Name:	
Responsible Rater Name:	Responsible Rater Signature:
Responsible Rater Certification Number w/ this HERS Provider:	Date Signed:

Registration Number:

Registration Date/Time:

HERS Provider:

CA Building Energy Efficiency Standards - 2016 Residential Compliance

<Date>

CF3R-MCH-24e-H User Instructions**Section A. Building Air Leakage – General Information**

1. Enter the indoor temperature measured at the time that the building air leakage test was performed.
2. Enter the outdoor temperature measured at the time that the building air leakage test was performed.
3. 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”)
4. 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.
5. This number is automatically pulled from the performance approach Certificate of Compliance. It is used to calculate air changes.
6. 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 Row A.6 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 (MCH24e) - Depressurization

1. Enter the time average period used on the manometer during the DEPRESSURIZATION test. Must be at least 10 seconds.
2. If ASTM E779-10 compliant software is being used for the calculations, enter “yes” here. Otherwise, choose “no”.

Note: A minimum of five and a maximum of nine data points are required for items C.3 and C.4 for this test.

3. Enter 5-9 Induced Building Pressure readings from the manometer (automatic baseline feature turned on). It should be close to -50 Pa, but no greater than -15 Pa.
4. Enter 5-9 Nominal CFM50 readings from the manometer.
5. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals $(C.4_1 + C.4_2 + C.4_3 + C.4_4 + C.4_5 + C.4_6 + C.4_7 + C.4_8 + C.4_9) / N$ or the number of tests = Average Nominal CFM50

Section D. Altitude and Temperature Correction (If Row C.2 = No)

1. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - a. If the elevation is less than or equal to 5,000 ft, then enter 1 as Altitude Correction in box D. 1
 - 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 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	

- This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals to the product of C.5 * D.1 * D.2.

Section E. Accuracy Adjustment

- This field is automatically calculated when using the online form. It is the Standard Deviation of the Nominal CFM50 values from Rows C.4₁ through C.4₉. The equation used to calculate this value in the field equals the square root of $\{[(C.5 - C.4_1)^2 + (C.5 - C.4_2)^2 + (C.5 - C.4_3)^2 + (C.5 - C.4_4)^2 + (C.5 - C.4_5)^2 + (C.5 - C.4_6)^2 + (C.5 - C.4_7)^2 + (C.5 - C.4_8)^2 + (C.5 - C.4_9)^2] / N - 1\}$ or the number of tests minus one) = Standard Deviation of the Nominal CFM50.
- This field is automatically calculated when using the online form. It is the Percent Uncertainty and the equation used to calculate this value in the field equals $\{(E.1 / \text{square root } N \text{ or the number of tests}) \times \text{t-statistic look up from table RA 3.8-1} / D.3 \text{ Corrected CFM50}\} = \text{Percent Uncertainty}.$

Table 3.8-1 Precision Uncertainty: Values of t-statistic

Number of Readings	t-statistic
5	2.78
6	2.57
7	2.45
8	2.37
9	2.31

- This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - If the Percent Uncertainty in E.2 ≤ 10, then enter "Standard" as Accuracy Level in box E. 3
 - If the Percent Uncertainty in E.2 > 10, then enter "Reduced" as Accuracy Level in box E. 3
- This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - If the Accuracy Level E.3 = Standard, then enter 1 as Accuracy Adjustment Factor in box E.4
 - If the Accuracy Level E.3 = Reduced, Accuracy Adjustment Factor equation equals $1 + (E.2 / 100)$
- This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals the D.3 * E.4 = Adjusted CFM50.
- Enter the Corrected CFM50 from manometer software.
- Enter the Percent Uncertainty from manometer software.

Section F. Envelope Leakage (MCH24e) – Pressurization

1. Enter the time average period used on the manometer during the PRESSURIZATION test. Must be at least 10 seconds.
2. If ASTM E779-10 compliant software is being used for the calculations, enter “yes” here. Otherwise, choose “no”.

Note: A minimum of five and a maximum of nine data points are required for items F.3 and F.4 for this test.

3. Enter 5-9 Induced Building Pressure readings from the manometer (automatic baseline feature turned on). It should be close to 50 Pa, but no less than 15 Pa.
4. Enter 5-9 Nominal CFM50 readings from the manometer.
5. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals $(F.4_1 + F.4_2 + F.4_3 + F.4_4 + F.4_5 + F.4_6 + F.4_7 + F.4_8 + F.4_9) / N$ or the number of tests = Average Nominal CFM50.

Section G. Altitude and Temperature Correction

1. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - c. If the elevation is less than or equal to 5,000 ft, then enter 1 as Altitude Correction in box G. 1
 - d. 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 RA3.8-3 using the indoor and outdoor temperatures entered in Section A.

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	0.961	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	

3. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals to the product of $F.5 * G.1 * G.2$.

Section H. Accuracy Adjustment

1. This field is automatically calculated when using the online form. It is the Standard Deviation of the Nominal CFM50 values from Rows F.4₁ through F.4₉. The equation used to calculate this value in the field equals the square root of $\{[(F.5 - F.4_1)^2 + (F.5 - F.4_2)^2 + (F.5 - F.4_3)^2 + (F.5 - F.4_4)^2 + (F.5 - F.4_5)^2 + (F.5 - F.4_6)^2 + (F.5 - F.4_7)^2 + (F.5 - F.4_8)^2 + (F.5 - F.4_9)^2] / N - 1$ or the number of tests minus one} = Standard Deviation of the Nominal CFM50.
2. This field is automatically calculated when using the online form. It is the Percent Uncertainty and the equation used to calculate this value in the field equals $\{(H.1 / \text{square root } N \text{ or the number of tests}) \times t\text{-statistic look up from table RA 3.8-1} / G.3 \text{ Corrected CFM50}\} = \text{Percent Uncertainty}$.

Table 3.8-1 Precision Uncertainty: Values of t-statistic

Number of Readings	t-statistic
5	2.78
6	2.57
7	2.45
8	2.37
9	2.31

3. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - c. If the Percent Uncertainty in H.2 \leq 10, then enter "Standard" as Accuracy Level in box H. 3
 - d. If the Percent Uncertainty in H.2 $>$ 10, then enter "Reduced" as Accuracy Level in box H. 3
4. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals:
 - c. If the Accuracy Level H.3 = Standard, then enter 1 as Accuracy Adjustment Factor in box H.4
 - d. If the Accuracy Level H.3 = Reduced, Accuracy Adjustment Factor equation equals $1+(H.2/100)$
5. This field is automatically calculated when using the online form. The equation used to calculate this value in the field equals the G.3 * H.4 = Adjusted CFM50.
6. Enter the Corrected CFM50 from manometer software.
7. Enter the Percent Uncertainty from manometer software.

Section I. Additional Requirements for Compliance

1. This statement must be true (or not applicable) for the test to conform to the protocols.
2. This statement must be true (or not applicable) for the test to conform to the protocols.
3. This statement must be true (or not applicable) for the test to conform to the protocols.
4. This statement must be true (or not applicable) for the test to conform to the protocols.
5. This statement must be true (or not applicable) for the test to conform to the protocols.