STATE OF CALIFORNIA
BUILDING LEAKAGE WORKSHEET
CEC-CF2R-MCH-24-H (Revised 06/14)   CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION	CF2R-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	Test Procedure Used:	
02	Indoor temperature during test (degreeF)	
03	Outdoor temperature during test (degreeF)	
04	Blower door location	
05	Building Elevation (ft)	
06	Building Volume (ft3)	
07	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 – MCH24b - Single Point Air Tightness Test With Automatic Meter - <<only used if this test is selected on row A. 1>>

01	Time average period of meter	
02	Average Baseline Building Pressure Reading #1	
03	Average Baseline Building Pressure Reading #2	
04	Average Baseline Building Pressure Reading #3	
05	Average Baseline Building Pressure Reading #4	
06	Average Baseline Building Pressure Reading #5	
07	Baseline Range	
08	Accuracy Level	
09	Average Baseline Building Pressure Reading	
10	Pre-test baseline building pressure	
11	Induced building pressure from manometer	
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	Extending factor	
02	Adjusted CFM50 Depressurization (measured air leakage rate)	

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Project Name:	Enforcement Agency:	Permit Number:
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F. Envelope Leakage Worksheet – Pressurization – MCH24b - Single Point Air Tightness Test With Automatic Meter - <<only used if this test is selected on row A. 1>>

01	Time average period of meter	
02	Average Baseline Building Pressure Reading #1	
03	Average Baseline Building Pressure Reading #2	
04	Average Baseline Building Pressure Reading #3	
05	Average Baseline Building Pressure Reading #4	
06	Average Baseline Building Pressure Reading #5	
07	Baseline Range	
08	Accuracy Level	
09	Average Baseline Building Pressure Reading	
10	Pre-test baseline building pressure	
11	Induced building pressure from manometer	
12	Induced building pressure check	
13	Nominal CFM50	

G. Altitude and Temperature Correction

01	Altitude correction factor	
02	Temperature correction factor	
03	Corrected CFM50	

H. Accuracy Adjustment

01	Extending factor	
02	Adjusted CFM50 Pessurization (measured air leakage rate)	

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.

CERTIFICATE OF INSTALLATION	CF2R-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 Installation documentation is accurate and complete.

Documentation Author Name:	Documentation Author Signature:
Documentation Author Company Name:	Date Signed:
Address:	CEA/HERS Certification Identification (If applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT

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

1. The information provided on this Certificate of Installation is true and correct.

2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction, or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Installation and attest to the declarations in this statement (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer.

3. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.

4. I understand that a HERS rater will check the installation to verify compliance, and that if such checking identifies defects; I am required to take corrective action at my expense. I understand that Energy Commission and HERS Provider representatives will also perform quality assurance checking of installations, including those approved as part of a sample group but not checked by a HERS rater, and if those installations fail to meet the requirements of such quality assurance checking, the required corrective action and additional checking/testing of other installations in that HERS sample group will be performed at my expense.

5. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met.

6. 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:
Third Party Quality Control Program (TPQCP) Status:	Name of TPQCP (if applicable):	

Instructions for MCH24b

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. Note that when the Total Ventilation Rate Method is used infiltration must be measured twice, once using under pressurization and once under depressurization. The MCH-27 (Ventilation) will use the average of those two measurements.
2. Enter the indoor temperature measured at the time that the building air leakage test was performed.
3. Enter the outdoor temperature measured at the time that the building air leakage test was performed.
4. 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".
5. Enter the building elevation use the value for the closest city found in Joint Appendix JA2.2. Only elevations higher than 5000 feet require an adjustment to the calculations.
6. This number is automatically pulled from the performance approach Certificate of Compliance. It is used to calculate air changes.
7. 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.8, 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 (MCH24b) - Depressurization

1. Enter the time average period used on the manometer during the DEPRESSURIZATION 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 when using the online form. 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 when using the online form. "Standard" is when the baseline range is less than 5 Pa; "Reduced" is when the baseline range is between 5 and 10 Pa (inclusive); c. If the baseline range is greater than 10 you must use a multi-point procedure.
9. This field is automatically calculated when using the online form. 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. All blower door induced pressures for the depressurization tests are to be negative relative to outside.
12. This field is automatically calculated when using the online form. 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). All blower door induced pressures for the depressurization tests are to be negative relative to outside.

Section D. 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:
   a. If the elevation 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 * 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*

		Inside Temperature (F)								
		50	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**
Outside Temp (F)	**-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

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

		Inside Temperature (F)								
		50	55	60	65	70	75	80	85	90
Outside Temp (F)	-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	09.17	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 Corrected CFM50 is the Nominal CFM50 from Section C multiplied times the Altitude and Temperature Correction Factors.

Section E. Accuracy Adjustment
1. This field is automatically calculated when using the online form.:
    a. If the Accuracy Level from section C is "Standard", the Accuracy Adjustment will be 1 (no adjustment)
    b. If the Accuracy Level from section C is "Reduced", accuracy adjustment equation equals 1+[0.1+(50/Nominal CFM50)]
2. This field is automatically calculated when using the online form. The Adjusted CFM50 is the Corrected CFM50 multiplied times the Accuracy Adjustment.
3.

Section F. Envelope Leakage (MCH24b) - Pressurization
1. Enter the time average period used on the manometer during the PRESSURIZATION 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 when using the online form. 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 when using the online form. "Standard" is when the baseline range is less than 5 Pa; "Reduced" is when the baseline range is between 5 and 10 Pa (inclusive); c. If the baseline range is greater than 10 you must use a multi-point procedure.
9. This field is automatically calculated when using the online form. 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. All blower door induced pressures for the pressurization tests are to be positive relative to outside.
12. This field is automatically calculated when using the online form. 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). All blower door induced pressures for the pressurization tests are to be positive relative to outside.

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 less than or equal to 5,000 ft, the altitude correction factor is 1 (no adjustment).
   d. If the elevation is greater than 5,000 ft, the altitude correction equation equals 1 + (0.000006 * 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*

		Inside Temperature (F)								
		50	55	60	65	70	75	80	85	90
Outside Temp (F)	-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

Section H. Accuracy Adjustment
4. This field is automatically calculated when using the online form.:
   c. If the Accuracy Level from section F is "Standard", the Accuracy Adjustment will be 1 (no adjustment)
   d. If the Accuracy Level from section F is "Reduced", accuracy adjustment equation equals 1+[0.1+(50/Nominal CFM50)]
5. This field is automatically calculated when using the online form. The Adjusted CFM50 is the Corrected CFM50 multiplied times the Accuracy Adjustment.
6.

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.