

DOCKETED

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|-------------------------|---|
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| Project Title: | Residential Compliance Manual and Documents |
| TN #: | 232820-16 |
| Document Title: | 2016-CF3R-ENV-20d-BuildingEnvelopeAirLeakage- RepeatedSinglePointTest-ManualMeterpdf |
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BUILDING LEAKAGE DIAGNOSTIC TEST

CEC-CF2R-ENV-20-H (Revised 01/16)

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) | |
| | | | | |

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|--|
| ENV20d – Repeated Single Point Air Tightness Test With Manual Meter |
|--|

| C. Envelope Leakage Diagnostic Test | | | | |
|-------------------------------------|---|------------------|---------------------------|---------------|
| 01 | Time Average Period of Meter | | | |
| 02 | Blower Door Software Used for Calculations? | | | |
| 03 | Test Methodology | | | |
| 04 | 05 | 06 | 07 | 08 |
| Baseline Building Pressure Reading | Unadjusted Building Pressure | Nominal Fan Flow | Induced Building Pressure | Nominal CFM50 |
| | | | | |
| | | | | |
| | | | | |
| 09 | Average Nominal CFM50 | | | |

| D. Altitude and Temperature Correction | |
|--|-------------------------------|
| 01 | Altitude Correction Factor |
| 02 | Temperature Correction Factor |
| 03 | Corrected CFM50 |

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| | | |
|----------------------------------|---------------------|----------------|
| 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: |

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 (measured air leakage rate) | |
| 06 | Corrected CFM50 (from software) | |
| 07 | Percent Uncertainty @ 95% Confidence Level (from software) | |

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-CF2R-ENV-20-H (Revised 01/16)

CALIFORNIA ENERGY COMMISSION



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|----------------------------------|---------------------|----------------|
| 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-ENV20d-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 (ENV-20d)

1. Enter the Time Average Period used on the manometer during the test. Must be at least 10 seconds.
2. This version of the MCH-24 can be used with an ASTM E779-10 compliant software, typically provided by the blower door manufacturer. Confirm with the software vendor that it is compliant.
3. Select the type of test being performed: Pressurization (air blowing into house) or Depressurization (air blowing out of house).
4. Enter five to nine Baseline Building Pressure Readings (Resolution of 0.1 Pa).
5. Enter five to nine Unadjusted Building Pressure numbers straight from the manometer.
6. Enter five to nine Nominal Fan Flows from the manometer that corresponds to the Unadjusted Building Pressure values.
7. This field is automatically calculated. The Induced Building Pressure is the difference between the Unadjusted Building Pressure and the Baseline Building pressure.
8. This field is automatically calculated. The Nominal Fan Flow at the Induced Building Pressure is adjusted mathematically for a target pressure of -50 Pa.
9. This field is automatically calculated. It is the average of the Nominal CFM50 values for the 5-9 repeated single point tests.

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 Pressurization Testing- Calculated according to ASTM E779-10

| Outside Temp (F) | Inside Temperature (F) | | | | | | | | | |
|------------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
| -20 | 1.062 | 1.072 | 1.081 | 1.090 | 1.099 | 1.108 | 1.117 | 1.127 | 1.136 | 1.145 |
| -15 | 1.056 | 1.066 | 1.075 | 1.084 | 1.093 | 1.102 | 1.111 | 1.120 | 1.129 | 1.138 |
| -10 | 1.051 | 1.060 | 1.069 | 1.078 | 1.087 | 1.096 | 1.105 | 1.114 | 1.123 | 1.132 |
| -5 | 1.045 | 1.054 | 1.063 | 1.072 | 1.081 | 1.090 | 1.099 | 1.108 | 1.117 | 1.126 |
| 0 | 1.039 | 1.048 | 1.057 | 1.066 | 1.075 | 1.084 | 1.093 | 1.102 | 1.111 | 1.120 |
| 5 | 1.033 | 1.042 | 1.051 | 1.060 | 1.069 | 1.078 | 1.087 | 1.096 | 1.105 | 1.114 |
| 10 | 1.028 | 1.037 | 1.046 | 1.055 | 1.064 | 1.072 | 1.081 | 1.090 | 1.099 | 1.108 |
| 15 | 1.023 | 1.031 | 1.040 | 1.049 | 1.058 | 1.067 | 1.076 | 1.084 | 1.093 | 1.102 |
| 20 | 1.017 | 1.026 | 1.035 | 1.044 | 1.052 | 1.061 | 1.070 | 1.079 | 1.087 | 1.096 |
| 25 | 1.012 | 1.021 | 1.029 | 1.038 | 1.047 | 1.056 | 1.064 | 1.073 | 1.082 | 1.091 |
| 30 | 1.007 | 1.015 | 1.024 | 1.033 | 1.041 | 1.050 | 1.059 | 1.067 | 1.076 | 1.085 |
| 35 | 1.002 | 1.010 | 1.019 | 1.028 | 1.036 | 1.045 | 1.054 | 1.062 | 1.071 | 1.080 |
| 40 | 0.997 | 1.005 | 1.014 | 1.023 | 1.031 | 1.040 | 1.048 | 1.057 | 1.065 | 1.074 |
| 45 | 0.992 | 1.000 | 1.009 | 1.017 | 1.026 | 1.035 | 1.043 | 1.051 | 1.060 | 1.069 |
| 50 | 0.987 | 0.995 | 1.004 | 1.012 | 1.021 | 1.029 | 1.038 | 1.046 | 1.055 | 1.064 |
| 55 | 0.982 | 0.990 | 0.999 | 1.008 | 1.016 | 1.024 | 1.033 | 1.041 | 1.050 | 1.059 |
| 60 | 0.997 | 0.986 | 0.994 | 1.003 | 1.011 | 1.019 | 1.028 | 1.036 | 1.045 | 1.054 |
| 65 | 0.973 | 0.981 | 0.989 | 0.998 | 1.006 | 1.015 | 1.023 | 1.031 | 1.040 | 1.049 |
| 70 | 0.968 | 0.976 | 0.985 | 0.993 | 1.001 | 1.010 | 1.018 | 1.026 | 1.035 | 1.044 |
| 75 | 0.963 | 0.972 | 0.980 | 0.988 | 0.997 | 1.005 | 1.013 | 1.022 | 1.030 | 1.039 |
| 80 | 0.959 | 0.967 | 0.976 | 0.984 | 0.992 | 1.000 | 1.009 | 1.017 | 1.025 | 1.034 |
| 85 | 0.955 | 0.963 | 0.971 | 0.979 | 0.988 | 0.996 | 1.004 | 1.012 | 1.020 | 1.029 |
| 90 | 0.950 | 0.958 | 0.967 | 0.975 | 0.983 | 0.991 | 0.999 | 1.008 | 1.016 | 1.025 |
| 95 | 0.946 | 0.954 | 0.962 | 0.970 | 0.979 | 0.987 | 0.995 | 1.003 | 1.011 | 1.020 |
| 100 | 0.942 | 0.950 | 0.958 | 0.966 | 0.970 | 0.982 | 0.990 | 0.998 | 1.007 | 1.016 |
| 105 | 0.938 | 0.946 | 0.954 | 0.962 | 0.970 | 0.978 | 0.986 | 0.994 | 1.002 | 1.011 |
| 110 | 0.933 | 0.942 | 0.950 | 0.952 | 0.966 | 0.974 | 0.982 | 0.990 | 0.998 | 1.007 |

Table RA3.8-3 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 | 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 | 0.988 | 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 (If Row C.2 = No)

- This field is automatically calculated. It is the Standard Deviation of the Nominal CFM50 values from the 5 to 9 repeated single point tests.
- This field is automatically calculated. It is the Percent Uncertainty and the equation used to calculate this value in the field equals $\{(C.1/\text{square root } N \text{ or the number of tests}) \times t\text{-statistic look up from table RA 3.8-1}/D.3 \text{ corrected CFM50}\} = \text{Percent Uncertainty}$.

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. 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. 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. The equation used to calculate this value in the field equals the $D.3 * E.4 = \text{Adjusted CFM50}$

Section E. Accuracy Adjustment (If Row C.2 = Yes)

- Enter the Corrected CFM50 from manometer software.
- Enter the Percent Uncertainty from manometer software.

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.

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.
6. *Verification Status:* If this Section does not apply, then select “All n/a”. If the system 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.
7. *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

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

For information and data collection only. Not valid until registered with a HERS provider

A. Building Air Leakage – General Information

| | | |
|----|---|---|
| 01 | Test Procedure Used | <<user input, pull down list: Single-Point Test with Manual Meter – Display ENV-20a below; Single-Point Test with Automatic Meter – Display ENV-20b below; Multi-Point Test – Display ENV-20c below; Repeated Single Point with Manual Meter – Display ENV-20d below; Repeated Single Point with Automatic Meter – Display ENV-20e below |
| 02 | Building Air Leakage Target from CF1R | <<number pulled from CF1R>> |
| 03 | Indoor Temperature During Test (°F) | <<user input, degF>> |
| 04 | Outdoor Temperature During Test (°F) | <<user input, degF>> |
| 05 | Blower Door Location | <<user input, text, maximum 50 characters>> |
| 06 | Building Elevation (ft) | <<user input, Ft>> |
| 07 | Building Volume (ft³) | <<pull from CF1R>> |
| 08 | Date of the Diagnostic Test for this Dwelling | <<user input: date (use date format validation control)>> |

B. Diagnostic Equipment Information

| | | | | | |
|----|--|---|---|---|--|
| 01 | Number of Manometers Used to Measure Home Pressurization | | | | <<user input, integer>> For entries >1, duplicate lines B. 2-6 |
| | 02 | 03 | 04 | 05 | 06 |
| | Manometer Make | Manometer Model | Manometer Serial Number | Manometer Calibration Date | Manometer Calibration Status |
| | <<user input, text, maximum 50 characters>> | <<user input, text, maximum 50 characters>> | <<user input, text, maximum 50 characters>> | <<user input, text (Date), maximum 50 characters>> | <<calculated field: if manometer Calibration Date in B. 5 is within 12 months of the date of the diagnostic test A. 8, then display message: Manometer Calibration is valid"; else display message: "WARNING - Manometer Calibration is expired. A manometer with current calibration is required in order to comply with this Building Leakage Diagnostic test">> |
| 07 | Number of Fans Used to Pressurize Home | | | <<user input, integer>> For entries >1, duplicate lines B. 8-11 | |
| | 08 | 09 | 10 | 11 | |
| | Fan Make | Fan Model | Fan Serial Number | Fan Configuration (rings) | |
| | <<user input, text, maximum 50 characters>> | <<user input, text, maximum 50 characters>> | <<user input, text, maximum 50 characters>> | <<user input, text, maximum 50 characters>> | |

ENV20d – Repeated Single Point Air Tightness Test With Manual Meter

C. Envelope Leakage Diagnostic Test

| | | | | |
|--|---|---|---|--|
| 01 | Time Average Period of Meter | <<user entry but must be no less than 10, in second>> | | |
| 02 | Blower Door Software Used for Calculations? | <<user entry, choices are "yes" or "no">> | | |
| 03 | Test Methodology | <<user input, pull down list: Pressurization; Depressurization>> | | |
| 04 | 05 | 06 | 07 | 08 |
| Baseline Building Pressure Reading | Unadjusted Building Pressure | Nominal Fan Flow | Induced Building Pressure | Nominal CFM50 |
| < required data> (Resolution of 0.1 Pa) | <required data> (Resolution of 0.1 Pa) | < required data> (Resolution of 1 CFM) | <<calculated field: = absolute value (C.5 - C.4)>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| < required data> (Resolution of 0.1 Pa) | <required data> (Resolution of 0.1 Pa) | < required data> (Resolution of 1 CFM) | <<calculated field: = [absolute value (C.5 - C.4)]>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| < required data> (Resolution of 0.1 Pa) | <required data> (Resolution of 0.1 Pa) | < required data> (Resolution of 1 CFM) | <<calculated field: = [absolute value (C.5 - C.4)]>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| < required data> (Resolution of 0.1 Pa) | <required data> (Resolution of 0.1 Pa) | < required data> (Resolution of 1 CFM) | <<calculated field: = [absolute value (C.5 - C.4)]>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| < required data> (Resolution of 0.1 Pa) | <required data> (Resolution of 0.1 Pa) | < required data> (Resolution of 1 CFM) | <<calculated field: = [absolute value (C.5 - C.4)]>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| < Lines 6-9 optional data> (Resolution of 0.1 Pa) | < optional data> (Resolution of 0.1 Pa) | < optional data> (Resolution of 1 CFM) | <<calculated field: = [absolute value (C.5 - C.4)]>> | <<calculated field: = (50/[C.7])^0.65 x [C.6]>> |
| 09 | Average Nominal CFM50 | | <<calculated value, = (C.8 ₁ +C.8 ₂ + C.8 ₃ + C.8 ₄ + C.8 ₅ +C.8 ₆ + C.8 ₇ + C.8 ₈ + C.8 ₉)/N (N equals the number of tests)>> | |

D. Altitude and Temperature Correction

| | | |
|--|-------------------------------|--|
| <<if row C. 2 = "no", use this section>> | | |
| 01 | Altitude Correction Factor | <<calculated value, if row A. 6 ≤ 5000 Ft = 1; row A. 6 > 5000 =, 1 + .000006 * row A. 6>> |
| 02 | Temperature Correction Factor | <<from tables RA3.8-2 and RA3.8-3>> |
| 03 | Corrected CFM50 | <<calculated value, Row C. 9*altitude correction D. 1 * temperature correction D. 2>> |

E. Accuracy Adjustment

| | | |
|---|---|--|
| <<if row C. 2 = "no", use this section>> | | |
| 01 | Standard Deviation of Nominal CFM 50 Values Above | <<calculated, equals the square root of {[(C.9- C.8 ₁)^2+(C.9- C.8 ₂)^2+(C.9- C.8 ₃)^2+(C.9 C.8 ₄)^2+(C.9- C.8 ₅)^2+(C.9- C.8 ₆)^2+(C.9- C.8 ₇)^2+(C.9- C.8 ₈)^2+(C.9- C.8 ₉)^2]/N-1 (N equals the number of tests)>> |
| 02 | Percent Uncertainty | <<calculated, {[std dev/sqrt(N)] * look up table RA 3.8-1}/corrected CFM50 (N equals the number of tests)>> |
| 03 | Accuracy Level | <<calculated, if % uncertainty ≤10, "Standard"; if % uncertainty > 10, "Reduced">> |
| 04 | Accuracy Adjustment Factor | <<calculated, if row E. 3 is "Standard"=1; If it is "Reduced", 1+ (% uncertainty/100)>> |
| 05 | Adjusted CFM50 (measured air leakage rate) | <<calculated, row D. 3 * row E. 4>> |
| <<if row C. 2 = "yes", use next two lines>> | | |
| 06 | Corrected CFM50 (from software) | << user entry of value calculated by software>> |
| 07 | Percent Uncertainty @ 95% Confidence Level (from software) | << user entry of value calculated by software>> |

F. Compliance Statement

| | |
|----|--|
| 01 | << if manometer Calibration Date in B. 5 is within 12 months of the date of the diagnostic test A. 8 and if Adjusted CFM50 Leakage in E. 5 or if corrected CFM50 Leakage in E. 6 is less than or equal to the Building Air Leakage Rate Target in A. 2 then display text: "Building Passes Envelope Leakage Test"; if manometer Calibration Date in B. 5 is more than 12 months from the date of the diagnostic test A. 8 or if Adjusted CFM50 Leakage in E. 5 or if corrected CFM50 Leakage in E. 6 is more than the Building Air Leakage Rate Target in A. 2 then display text: "Building Fails Envelope Leakage Test">> |
|----|--|

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 | <table border="1" style="width: 100%;"> <tr> <td style="width: 25%;">Verification Status:</td> <td><<user pick from list: *** <u>Pass</u> - all applicable requirements are met; or *** <u>Fail</u> - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or *** <u>All n/a</u> - This entire table is not applicable</td> </tr> </table> | Verification Status: | <<user pick from list: *** <u>Pass</u> - all applicable requirements are met; or *** <u>Fail</u> - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or *** <u>All n/a</u> - This entire table is not applicable |
| Verification Status: | <<user pick from list: *** <u>Pass</u> - all applicable requirements are met; or *** <u>Fail</u> - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or *** <u>All n/a</u> - This entire table is not applicable | | |
| 07 | Correction Notes: <<if Verification Status= Fail, then text entry in this Corrections Notes field is required; user input text>> | | |

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 | <<if B. 6 = Manometer Calibration is valid; and F. 1 = Building Passes Envelope Leakage Test; and G. 6 = Pass or All n/a; then display: Complies: All specified verification protocol requirements on this document are met; else display: Does not comply: One or more specified verification protocol requirements on this document are not met.>> |
|----|--|