|  |  |  |
| --- | --- | --- |
| **A. Enclosure Air Leakage – General Information** | | |
| 01 | Is HERS verification of building enclosure air leakage to outside required by MCH-27? |  |
| 02 | Is HERS verification of dwelling compartmentalization leakage ≤ 0.3 CFM50/ft2 of enclosure area required by MCH-27? |  |
| 03 | Default Enclosure Air Leakage |  |
| 04 | Indoor temperature during test (°F) |  |
| 05 | Outdoor temperature during test (°F) |  |
| 06 | Blower Door Location |  |
| 07 | Building Elevation Above Sea Level (ft) |  |
| 08 | Total dwelling unit floor area (ft2) |  |
| 09 | Total dwelling unit ceiling area (ft2) |  |
| 10 | Total dwelling unit exterior wall area (ft2) |  |
| 11 | Total dwelling unit wall area shared with other dwelling units (ft2) |  |
| 12 | Total dwelling unit enclosure area (ft2) |  |
| 13 | Building Volume |  |
| 14 | Target dwelling unit compartmentalization leakage (CFM50) |  |
| 15 | Date of the Diagnostic Test for this Dwelling |  |
| 16 | Test Procedure used |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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) | |
|  | | |  | |  | | |  | |
|  | | |  | |  | | |  | |

|  |
| --- |
| **MCH24a - Single Point Air Tightness Test With Manual Meter** |

|  |  |  |
| --- | --- | --- |
| **C. Enclosure Air Leakage Diagnostic Test** | | |
| 01 | Time Average Period of Meter (seconds) |  |
| 02 | Test Methodology |  |
| 03 | Pre-Test Baseline Enclosure Pressure (Pa)  (May be positive or negative) |  |
| 04 | Unadjusted Enclosure Pressure Target (Pa) |  |
| 05 | Unadjusted Enclosure Pressure Measured (Pa)  (Pressurization is positive; Depressurization is negative) |  |
| 06 | Induced Enclosure Pressure Difference (Pa)  Goal = 50 ± 3  (Pressurization is positive; Depressurization is negative) |  |
| 07 | Induced Enclosure Pressure Check |  |
| 08 | Measured Nominal Fan Flow at Above Fan Pressure (cfm) at the Induced Enclosure Pressure Difference (in C06 above) |  |
| 09 | Calculated Nominal CFM50 |  |

|  |  |  |
| --- | --- | --- |
| **D. Altitude and Temperature Correction** | | |
| 01 | Altitude and Temperature Correction Factor |  |
| 02 | Corrected CFM50 |  |
| 03 | ACH50 |  |

|  |  |  |
| --- | --- | --- |
| **E. Accuracy Adjustment** | | |
| 01 | Adjusted CFM50 (measured air leakage rate) |  |

|  |  |
| --- | --- |
| **F. Measured Enclosure Air Leakage Rate** | |
| 01 |  |

|  |  |
| --- | --- |
| **G. Additional Requirements for Worksheet Compliance** | |
| 01 | The procedure for preparing the enclosure for testing is detailed in RESNET 380-2016 Section 3.2. |
| 02 | When multifamily attached dwelling units must comply with the maximum dwelling unit enclosure air leakage specified in Standards Section 150.0(o)1Eii, the test shall be conducted with the dwelling unit as if it were exposed to the outdoor air on all sides, top and bottom by opening doors and windows of adjacent dwelling units as specified by RA3.8.3.1. |
| 03 | The procedure for installation of the test apparatus, and preparations for measurement shall conform to RESNET 380-2016 Section 3.3 |
| 04 | The procedure for the conduct of the enclosure air leakage test shall conform to the One-Point Airtightness Test specified in RESNET 380-2016 Section 3.4.1 |

|  |  |  |  |
| --- | --- | --- | --- |
| **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:The information provided on this Certificate of Installation is true and correct.I am either: a) a responsible person 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, or b) I am an authorized representative of the responsible person and attest to the declarations in this statement on the responsible person’s behalf.  1. 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 Certificate of Compliance, plans, and specifications approved by the enforcement agency. 2. I understand that a HERS rater will check the installation to verify compliance and if such checking determines the installation fails to comply, I am required to offer any necessary corrective action at no charge to the building owner. 3. 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): | | |

**CF2R-MCH-24a-H User Instructions**

**Section A. Enclosure Air Leakage – General Information**

1. This field is automatically filled from the MCH-27 which determines if a 2ACH50 value is required.
2. This field is automatically filled from the MCH-27 which determines if a 0.3CFM/ft2 value is required.
3. This field displays the 2ACH50 default enclosure air leakage.
4. Enter the indoor temperature measured at the time that the enclosure air leakage test was performed.
5. Enter the outdoor temperature measured at the time that the enclosure air leakage test was performed.
6. 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”.
7. Enter the building elevation above sea level. Use the value for the closest city found in Joint Appendix JA2.2.
8. Enter the total dwelling unit floor area if HERS verification of dwelling compartmentalization leakage is required.
9. Enter the total dwelling unit ceiling area if HERS verification of dwelling compartmentalization leakage is required.
10. Enter the total dwelling unit exterior wall area if HERS verification of dwelling compartmentalization leakage is required.
11. Enter the total dwelling unit wall area shared with other dwelling units if HERS verification of dwelling compartmentalization leakage is required.
12. This field is automatically calculated as the sum of the total dwelling unit surface area if HERS verification of dwelling compartmentalization leakage is required.
13. This field is automatically calculated unless the CF1R is an NCB or ADD.
14. This field is automatically calculated as the target dwelling unit compartmentalization leakage value if HERS verification of dwelling compartmentalization leakage is required.
15. Enter the date that the enclosure air leakage test data was collected.
16. Select the appropriate test procedure. This selection will determine which version of this document will be used (a or b). Not that newer manometers have automatic functions for compensating baseline (automatic baseline) and compensating for house pressures other than the target (50 Pa). It is preferable to use these when available.

**Section B. Diagnostic Equipment Information**

1. Enter the number of manometers used to measure the enclosure 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 enclosure air leakage data. Examples: Retrotec, Energy Conservatory.
3. Enter the model of the manometer used to collect the enclosure air leakage data. Examples: DM-2 Mark II, DG700.
4. Enter the serial number of the manometer used to collect the enclosure 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 A08 above, an error will appear.
7. Enter the number of blower door fan systems required to run simultaneously to pressurize the enclosure for the enclosure 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 enclosure air leakage data. Examples: Retrotec, Energy Conservatory.
9. Enter the model of the fan used to collect the enclosure air leakage data. Examples: US1000, Q46, BD3, BD4.
10. Enter the serial number of the fan used to collect the enclosure 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. Enclosure Air Leakage Test (MCH24a)**

1. Enter the Time Average Period used on the manometer during the test. Must be at least 10 seconds.
2. Select the type of test being performed: Pressurization (air blowing into house) or depressurization (air blowing out of house).
3. Enter the pre-test baseline enclosure pressure. This is the reading on the manual manometer with no fans turned on.
4. This field is automatically calculated. This is the enclosure pressure target value the enclosure needs to achieve during the test.
5. Enter the unadjusted enclosure pressure measured. This value is read from the manual manometer during the test.
6. This field is automatically calculated. This value is the difference of the unadjusted enclosure pressure measured and the pre-test baseline enclosure pressure. The goal is to achieve 50 ± 3 Pa.
7. This field is automatically calculated. This field determines if the pressure achieved is acceptable to proceed with the enclosure air leakage test.
8. Enter the measured nominal fan flow at above fan pressure from the manometer that corresponds to the induced enclosure pressure difference.
9. This field is automatically calculated. The induced enclosure pressure difference is converted to a nominal airflow at 50 Pa.

**Section D. Altitude and Temperature Correction**

1. This field is automatically calculated. This factor is determined based on the altitude and temperature of the building location using equation 4 in Section 9 of ASTM E779-10.
2. This field is automatically calculated. The corrected CFM50 is the nominal CFM50 from Section C multiplied by the altitude and temperature correction factor.

**Section E. Accuracy Adjustment**

1. This field is automatically calculated. This value is determined from equation 5a from ANSI/RESNET/ICC 380-2016.

**Section F. Measured Enclosure Air Leakage Rate**

1. This field is automatically calculated. A check is performed to make sure that the meter has been properly calibrated.

**Section G. Additional Requirements for Worksheet 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.

|  |  |  |
| --- | --- | --- |
| **A. Enclosure Air Leakage – General Information** | | |
| 01 | Is HERS verification of building enclosure air leakage to outside required by MCH-27? | <<calculated field: If MCH-27 requires HERS verification of building enclosure air leakage, then value = Required, else value = N/A>> |
| 02 | Is HERS verification of dwelling compartmentalization leakage ≤ 0.3 CFM50/ft2 of enclosure area required by MCH-27? | <<calculated field: If MCH-27 requires HERS verification of compartmentalization leakage, then value = Required, else value = N/A>> |
| 03 | Default Enclosure Air Leakage | <<if A01=required, then value = 2 ACH50 ; else value = N/A>> |
| 04 | Indoor temperature during test (°F) | <<user input, numeric, x.x degF>> |
| 05 | Outdoor temperature during test (°F) | <<user input, numeric, x.x degF>> |
| 06 | Blower Door Location | <<user input, text, maximum 50 characters>> |
| 07 | Building Elevation Above Sea Level (ft) | <<user input, integer, xxxxx >> |
| 08 | Total dwelling unit floor area (ft2) | <<if A02≠"required", then value = N/A;  Else user input numeric value, xxxxx.x >> |
| 09 | Total dwelling unit ceiling area (ft2) | <<if A02≠"required", then value = N/A;  Else user input numeric value, xxxxx.x >> |
| 10 | Total dwelling unit exterior wall area (ft2) | <<if A02≠"required", then value = N/A;  Else user input numeric value, xxxxx.x >> |
| 11 | Total dwelling unit wall area shared with other dwelling units (ft2) | <<if A02≠"required", then value = N/A;  Else user input numeric value, xxxxx.x >> |
| 12 | Total dwelling unit enclosure area (ft2) | << if A02≠"required", then value = N/A;  Else value = sum of (A08+A09+A10+A11) >> |
| 13 | Building Volume | <<if performance, reference from CF1R; Elseif prescriptive, user input>> |
| 14 | Target dwelling unit compartmentalization leakage (CFM50) | <<calculated: if A02=required, then value = A12\*0.3;  else value = N/A >> |
| 15 | Date of the Diagnostic Test for this Dwelling | <<user input: date (use date format validation control)>> |
| 16 | Test Procedure used | << user pick text value from following list of two:  \*\*Single-Point Test with Manual Meter  \*\*Single-Point Test with Automatic Meter>> |
|  | this field not visible on completed document, used only to determine the variant for completion of the document. | << if A16= Single-Point Test with Manual Meter, then use variant MCH-24a;  Else if A16=Single-Point Test with Automatic Meter, then use variant MCH-24b>> |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 B05 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 Enclosure Air Leakage worksheet">> |
|  | |  | |  | | |  | |  |
| 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>> | |
|  | | |  | |  | | |  | |

|  |
| --- |
| **MCH24a - Single Point Air Tightness Test With Manual Meter** |

|  |  |  |
| --- | --- | --- |
| **C. Enclosure Air Leakage Diagnostic Test** | | |
| 01 | Time Average Period of Meter (seconds) | <<user enter integer ≥ 10>> |
| 02 | Test Methodology | <<user input, user pick one of the following 2 text values:  \*\*Pressurization;  \*\*Depressurization;>> |
| 03 | Pre-Test Baseline Enclosure Pressure (Pa)  (May be positive or negative) | <<user enter numeric xx.x: -40 ≤value≥ 40>> |
| 04 | Unadjusted Enclosure Pressure Target (Pa) | <<calculated value: if C02 = Pressurization, then value =50 +C03; elseif  C02=Depressurization then value=(-50) + C03>> (Resolution of 0.1) |
| 05 | Unadjusted Enclosure Pressure Measured (Pa)  (Pressurization is positive; Depressurization is negative) | <<user enter numeric xx.x: -75.0 ≥ value ≤ 75>> |
| 06 | Induced Enclosure Pressure Difference (Pa)  Goal = 50 ± 3  (Pressurization is positive; Depressurization is negative) | <<calculated numeric value xx.x = C05-C03>> |
| 07 | Induced Enclosure Pressure Check | <<calculated value, if absolute value ( C06) ≥ 15 Pa), display text: “Induced pressure within range for single point test; else display text: “Induced pressure too low for single point test - **Do Not Proceed**”>> |
| 08 | Measured Nominal Fan Flow at Above Fan Pressure (cfm) at the Induced Enclosure Pressure Difference (in C06 above) | <<user enter integer value, >> (Resolution of 1 CFM) |
| 09 | Calculated Nominal CFM50 | <<calculated value, value = C08 \* (50/[absolute value (C05 – C03)])0.65 \*>> |

|  |  |  |
| --- | --- | --- |
| **D. Altitude and Temperature Correction** | | |
| a1 | Outside Dynamic Viscosity of Air Correction  \*\*(this row is not visible to user) | <<if C02 = Depressurization, then value={2.629\*10-3\*[(A05+460)0.5]}/[1+(198.7/(A05+460))];  else report “NA”>> |
| a2 | Indoor Dynamic Viscosity of Air Correction  \*\*(this row is not visible to user) | << if C02 = Pressurization, then value={2.629\*10-3\*[(A04+460)0.5]}/[1+(198.7/(A04+460))];  else report “NA”>> |
| a3 | Outdoor Air Density Correction  \*\*(this row is not visible to user) | <<if C02 = Depressurization, then value=0.07517\*[1-((0.0035666\*A07)/528)]5.2553\*(528/{A05+460});  else if C02 = Pressurization, then report “NA”>> |
| a4 | Indoor Air Density Correction \*\*(this row is not visible to user) | <<if C01 = Pressurization, then value=0.07517\*[1-((0.0035666\*A07)/528)]5.2553\*(528/{A04+460}); else report “NA”>> |
| 01 | Altitude and Temperature Correction Factor | <<if C02 = Depressurization, then value= [{(Da1)/0.044}2\*(0.65)-1] \*[{(Da3)/0.07517}1-0.65];  Else if CO2 = Pressurization, then value = [{(Da2)/0.044}2\*(0.65)-1] \*[{(Da4)/0.07517}1-0.65]; |
| 02 | Corrected CFM50 | <<else value = C09\*D01>> |
| 03 | ACH50 | <<value = ((D02 \* 60) / Building volume from A13)>> |

|  |  |  |
| --- | --- | --- |
| **E. Accuracy Adjustment** | | |
| 01 | Adjusted CFM50 (measured air leakage rate) | <<value = D02 \* 1.1>> |

|  |  |
| --- | --- |
| **F. Measured Enclosure Air Leakage Rate** | |
| 01 | << if calibration date in B05 is more than 12 months from the date of the diagnostic test in A15, then display text: “Manometer Calibration is expired, A manometer with current calibration is required in order to comply with this Enclosure Air Leakage worksheet";  elseif A01 = required, then (value) =E01\*60/(Building Volume from A13) and display text: “Enclosure Air Leakage Rate is (value) ACH50;  elseif A02 = required, then display text: “Enclosure Air Leakage Rate is (E01) CFM50”>> |

|  |  |
| --- | --- |
| **G. Additional Requirements for Worksheet Compliance** | |
| 01 | The procedure for preparing the enclosure for testing is detailed in RESNET 380-2016 Section 3.2. |
| 02 | When multifamily attached dwelling units must comply with the maximum dwelling unit enclosure air leakage specified in Standards Section 150.0(o)1Eii, the test shall be conducted with the dwelling unit as if it were exposed to the outdoor air on all sides, top and bottom by opening doors and windows of adjacent dwelling units as specified by RA3.8.3.1. |
| 03 | The procedure for installation of the test apparatus, and preparations for measurement shall conform to RESNET 380-2016 Section 3.3 |
| 04 | The procedure for the conduct of the enclosure air leakage test shall conform to the One-Point Airtightness Test specified in RESNET 380-2016 Section 3.4.1 |