

**DOCKETED**

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| <b>Filer:</b>           | Corrine Fishman                                    |
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**REFRIGERANT CHARGE VERIFICATION**

CEC-CF2R-MCH-25-H (Revised 10/16)

CALIFORNIA ENERGY COMMISSION



|                                 |                     |                |
|---------------------------------|---------------------|----------------|
| CERTIFICATE OF INSTALLATION     |                     | CF2R-MCH-25e-H |
| Refrigerant Charge Verification |                     | (Page 1 of 5)  |
| Project Name:                   | Enforcement Agency: | Permit Number: |
| Dwelling Address:               | City:               | Zip Code:      |

**A. System Information**

Each system requiring refrigerant charge verification will be documented on a separate certificate.

|    |  |  |
|----|--|--|
| 01 | System Identification or Name  |  |
| 02 | System Location or Area Served   |  |
| 03 | Condenser (or package unit) Make or Brand  |  |
| 04 | Condenser (or package unit) Model Number   |  |
| 05 | Nominal Cooling Capacity (tons) of Condenser   |  |
| 06 | Condenser (or package unit) Serial Number  |  |
| 07 | Refrigerant Type   |  |
| 08 | Other Refrigerant Type (if applicable)   |  |
| 09 | Liquid Line Filter Drier installed according to Manufacturer's Specification (if applicable)   |  |
| 10 | System Installation Type   |  |
| 11 | Fault Indicator Display (FID) Status<br>(Note: Even systems with a FID must have refrigerant charge verified by installer)   |  |
| 12 | Is the system of a type that the minimum airflow can be verified using an approved measurement procedure (RA3.3 or RA3.3.3)?   |  |
| 13 | Is the system of a type that approved refrigerant charge verification procedures can be used to verify compliance with the refrigerant charge verification requirements when temperatures are $\geq 55^{\circ}\text{F}$ (RA3.2.2, or RA1)? |  |
| 14 | Date of Refrigerant Charge Verification for this System  |  |
| 15 | Refrigerant Charge Verification Method Used  |  |
| 16 | Person who Performed the Refrigerant Charge Verification Reported on this Certificate of Installation  |  |
| 17 | HERS Verification Compliance Requirement Status  |  |

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**MCH-25e - Refrigerant Charge Verification - Winter Setup**

- Winter Setup for the Standard Charge Verification Procedure is specified in Reference Residential Appendix RA1.2.
- Procedures for determining Refrigerant Charge using the Standard Charge Verification Procedure are given in Reference Residential Appendix RA3.2.2.

**B. System Model Applicability for Winter Setup Method**

|    |   |  |
|----|---|--|
| 01 | Refrigerant Metering Device Type  |  |
| 02 | Winter Setup Method Applicability Status  |  |
| 03 | The responsible person's signature on this document indicates confirmation that the installed model number is currently listed as approved for Winter Setup Method on the Energy Commission website:<br><a href="http://www.energy.ca.gov/title24/2008standards/special_case_appliance/">http://www.energy.ca.gov/title24/2008standards/special_case_appliance/</a> |  |

**C. Instrument Calibration**

Instrumentation specifications and procedures for instrument calibration are given in Reference Residential Appendix RA3.2.2.2 and RA3.2.2.4 respectively.

|    |   |  |
|----|---|--|
| 01 | Date of Digital Refrigerant Gauge Calibration |  |
| 02 | Date of Digital Thermocouple Calibration      |  |
| 03 | Digital Refrigerant Gauge Calibration Status  |  |
| 04 | Digital Thermocouple Calibration Status       |  |

**D. Measurement Access Hole (MAH) Verification**

Procedures for installing MAH are specified in Reference Residential Appendix RA3.2.2.3.

|    |  |  |
|----|--|--|
| 01 | Method Used to Demonstrate Compliance with the Measurement Access Hole (MAH) Requirement |  |
|----|--|--|

**E. Minimum System Airflow Rate Verification**

Procedures for verifying minimum system airflow are specified in Reference Residential Appendix RA3.3.3.

|    |  |  |
|----|--|--|
| 01 | Minimum Required System Airflow Rate (cfm) |  |
| 02 | System Airflow Rate Verification Status    |  |



|                                 |                     |                |
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**F. Data Collection and Calculations**

Procedures for data collection and variable metering device calculations are given in Reference Residential Appendix RA3.2.2.5 and RA3.2.2.6.2 respectively.

|    |   |
|----|---|
| 01 | The responsible person's signature on this document indicates confirmation that, with a Condenser Outlet Air Restrictor installed, and after system operation was stabilized for at least 15 minutes, throughout the data collection for this verification, the difference between the liquid line pressure and suction line pressure was maintained between 160 and 220 psi for R-410A systems, or between 100 and 145 psi for R-22 systems. |
| 02 | Lowest return air dry-bulb temperature that occurred during the refrigerant charge verification procedure (°F)  |
| 03 | Measured Condenser Air Entering Dry-bulb Temperature ( $T_{\text{condenser, db}}$ ) (°F)  |
| 04 | Outdoor Temperature Qualification Status  |
| 05 | Measured Liquid Line Temperature ( $T_{\text{liquid}}$ ) (°F)   |
| 06 | Measured Liquid Line Pressure ( $P_{\text{liquid}}$ ) (psig)  |
| 07 | Condenser Saturation Temperature ( $T_{\text{condensor, sat}}$ ) from Digital Gauge or P-T Table using Line F06 (°F)  |
| 08 | Measured Subcool (Line F07 – Line F05) (°F)   |
| 09 | Target Subcool from Manufacturer (°F)   |
| 10 | Compliance Statement:   |

**G. Metering Device Verification**

Procedures for the verification of proper metering device operation are specified in RA3.2.2.5.2.

|    |  |
|----|--|
| 01 | Measured Suction Line Temperature ( $T_{\text{suction}}$ ) (°F)  |
| 02 | Measured Suction Line Pressure ( $P_{\text{suction}}$ ) (psig)   |
| 03 | Evaporator Saturation Temperature ( $T_{\text{evaporator, sat}}$ ) from Digital Gauge or P-T Table using line G02 (°F) |
| 04 | Measured Superheat (Line G01 – Line G03) (°F)  |
| 05 | Measured Superheat (Line G04) is between 4°F and 25°F (inclusive)  |
| 06 | Measured Superheat (Line G04) is within Manufacturer's Specifications (if known)                                       |
| 07 | Compliance Statement:  |

**H. Confirmation of Refrigerant Pressure Differential**

Procedures for the Winter Setup are detailed in RA1.2.22.

|    |   |
|----|---|
| 01 | $P_{\text{high}} - P_{\text{low}}$ (psi) from F06 and G02 |
| 02 | Compliance Statement:                                     |

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**MCH-25d - Refrigerant Charge Verification - Fault Indicator Display (FID)****I. Fault Indicator Display**

Procedures for the Fault Indicator Display Verification are detailed in RA3.4.2.

|    |   |  |
|----|---|--|
| 01 | FID Manufacturer Name/Make  |  |
| 02 | FID Model Number  |  |
| 03 | The display module is mounted adjacent to the system thermostat.  |  |
| 04 | The manufacturer has certified to the Energy Commission that the FID model meets the requirements of Reference Joint Appendix JA6 (Make and model found on CEC list of approved FID devices). |  |
| 05 | The system has operated for at least 15 minutes and the FID reports that the system is operating within acceptable parameters.  |  |

**J. Fault Indicator Display – Additional Requirements**

|   |   |
|---|---|
| 01  | Fault Indicator Display devices shall either be factory installed by the space-conditioning system manufacturer, or field installed according to the space-conditioning system manufacturer's requirements and the FID manufacturer's specifications. |
| 02  | The installer shall ensure that a copy of the FID manufacturer's user instructions documentation has been made available to the building owner.   |
| <b>The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.</b> |   |

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| 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:

- 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.
- 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.
- 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.
- 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-25e-H User Instructions****Section A. System Information**

1. This information is automatically pulled from the Certificate of Installation (MCH-01).
2. This information is automatically pulled from the Certificate of Installation (MCH-01)
3. This information is automatically pulled from the Certificate of Installation (MCH-01).
4. This information is automatically pulled from the Certificate of Installation (MCH-01)
5. This information is automatically pulled from the Certificate of Installation (MCH-01).
6. This information is automatically pulled from the Certificate of Installation (MCH-01)
7. Choose the type of refrigerant used by the system being verified.
8. If “Other” is chosen in A07, then indicate the type of refrigerant being used. If R-22 or R-410A is being used (regardless of trade name, Puron, Genetron, etc.) it should be indicated in A07. This row is only for refrigerants other than R-22 and R-410a. Documentation of refrigerant may be requested.
9. If applicable, a liquid line filter drier shall be installed according to manufacturer’s specifications.
10. Indicate whether the HVAC system is Completely New, Replacement or an Alteration. These are defined in detail the Residential Compliance Manual.
11. Select the appropriate choice regarding whether this system has a Fault Indicator Display (FID). Qualifying FID’s may exempt a system from HERS refrigerant charge verification. FID’s are described in Joint Appendix JA6.1. Qualifying FID’s must appear on a list of approved devices kept by the Commission.
12. Most ducted split systems and package systems are of the type that minimum airflow can be verified using an approved measurement procedure. Examples of systems that do not meet this description are ductless systems. Selecting “No” here may subject the project to additional scrutiny by enforcement personnel.
13. Most ducted split systems and package systems are of the type that approved refrigerant charge verification procedures detailed in Residential Appendix RA3.2.2 or RA1 can be used (i.e., Standard Charge Verification or Winter Setup Verification procedures). Examples of systems that may not meet this description are “mini splits” or variable refrigerant flow systems that may only be charged using weigh-in procedures. Selecting “No” here may subject the project to additional scrutiny.
14. Specify the date the refrigerant charge verification was performed.
15. Select the refrigerant charge verification method used from the choices provided:
  - Superheat (outdoor temperature must be  $\geq 55^{\circ}\text{F}$ ); this verification method can only be used when the outdoor temperature is at or above  $55^{\circ}\text{F}$ . It is only used on systems with fixed orifice refrigerant metering devices (non-variable metering devices). This method is detailed in Reference Appendix RA3.2.2.6.1. Systems verified using this method may be eligible for HERS verification compliance using sampling. Choosing this option will generate a CF2R-MCH-25a.
  - Subcooling (outdoor temperature must be  $\geq 55^{\circ}\text{F}$ ); this verification method can only be used when the outdoor temperature is at or above  $55^{\circ}\text{F}$ . It is only used on systems with variable metering devices (TXV or EXV). This method is detailed in Reference Appendix RA3.2.2.6.2. Systems verified using this method may be eligible for HERS verification compliance using sampling. Choosing this option will generate a CF2R-MCH-25b.
  - Weigh-in; this verification method can be used at any outdoor temperature allowed by the equipment manufacturer. This method is detailed in Reference Appendix RA3.2.3. Systems verified using this method are NOT eligible for HERS verification compliance using Group Sampling. Choosing this option will generate a CF2R-MCH-25c.
  - Winter Setup (applicable when outdoor temperature is  $< 55^{\circ}\text{F}$ ); the Winter Setup verification method is a special version of the Subcooling method. It can be used when the outdoor temperature is between  $37^{\circ}\text{F}$  and  $55^{\circ}\text{F}$ . It can only be used on equipment where the manufacturer has specifically approved it for the equipment being tested. The Winter Setup procedure is details in Residential Appendix RA1.2. Choosing this option will generate a CF2R-MCH-25e.
  - New Package Unit Factory Charge; Choose this option when a new package unit is being installed that has an AHRI rating. This helps ensure that the unit was properly charged at the factory. HERS verification of refrigerant charge may not be required in this case. Choosing this option will generate a CF2R-MCH-25f.
16. Identify who will be performing the verification that is documented on this Certificate of Installation, select from the two options. Note that HERS verification compliance by Group Sampling requires that the installer perform their own refrigerant charge verification as part of the installation of the equipment prior to the system being put into a sample group for possible selection by a HERS rater for verification. If Group Sampling is not intended, the HERS Rater may perform the refrigerant charge verification in behalf of the Installing Contractor (applies to any method but Weigh-In) and the Rater will enter same results on both the CF2R and CF3R.
17. The Group Sampling status is automatically displayed based on the input results of A15 and A16. Group Sampling procedures are detailed Residential Appendix RA2.3.

**Section B. System Model Applicability for Winter Setup Method**

1. Select the correct metering device used on the system being verified. This will check against the refrigerant charge verification method selected in A15. An error message will appear in B02 if the wrong verification method is selected. The Winter Setup Method can only be used on systems with variable metering devices (TXV or EXV).
2. An error message in here indicates that the wrong verification method has been selected. The Winter Setup Method can only be used on systems with variable metering devices (TXV or EXV).
3. Winter Setup Method shall only be used on system model numbers that have a TXV or EXV, and for which the manufacturer has provided written approval to the energy Commission indicating that the Winter Setup Method may be used to verify refrigerant charge. The list of approved systems can be found at the web address shown on the form. The installer must confirm that the model number for the equipment being verified appears on this list.

**Section C. Instrument Calibration**

1. Enter the date of most recent Digital Refrigerant Gauge Calibration Field Check. Analog gauges are not allowed for verification purposes under the 2016 Standards. Specification for pressure gauges is found in Residential Appendix RA3.2.2.2.3. Procedures for the field check procedure are detailed in RA3.2.2.4.2. Calibration field check must happen at least once every 30 days.
2. Enter the date of the most recent Digital Thermocouple Calibration. Specifications for thermocouples and temperature sensors can be found in Residential Appendix RA3.2.2.2.2. Procedures for calibration are detailed in RA3.2.2.4.1. Calibration must happen at least once every 30 days.
3. Digital Refrigerant Gauge Calibration status will appear automatically. If the date entered in C01 is more than 30 days prior to date of verification this row will indicate that calibration is required and you will not be allowed to continue filling out this document until calibration is performed.
4. Digital Thermocouple Calibration status will appear automatically. If the date entered in C02 is more than 30 days prior to date of verification this row will indicate that calibration is required and you will not be allowed to continue filling out this document until calibration is performed.

**Section D. Measurement Access Hole (MAH) Verification**

1. Indicate the method used to demonstrate compliance with the MAH requirement by selecting the appropriate method from the drop down list. Procedures for installing MAH's are detailed in RA3.2.2.3. Selecting that the MAH cannot be installed consistent with Figure 3.2-1 may result in additional scrutiny by enforcement personnel.

**Section E. Minimum System Airflow Rate Verification**

1. This information is automatically calculated based on the information given in A10. This is the target minimum system airflow required for the system being verified.
2. This information is automatically calculated based on the MCH-23 or MCH-28, which documents the measured airflow (or alternative method) of the system being verified. If the measured airflow is not adequate it will not comply with the airflow requirements and refrigerant charge verification cannot be performed until the airflow meets the requirement.

**Section F. Winter Setup Method – Data Collection and Calculations**

1. The Winter Setup Method is a variation on the Subcooling Method and involves using a Condenser Outlet Restrictor to drive up the refrigerant pressures. The procedures for this are detailed in Residential Appendix RA1.2.2
2. Measure and record the lowest return air dry-bulb temperature that occurred during the refrigerant charge procedure, in °F. This temperature must remain above 70°F during the verification procedure. This requirement is detailed in Residential Appendix RA3.2.2.5.
3. Measure and record the condenser air dry-bulb temperature ( $T_{\text{condenser}}$ ) in °F. This value must be at least 37°F and no more than 70°F to use the Subcooling Charge Verification Method.
4. If a value less than 37°F or greater than 70°F is entered in F03 the Subcooling Method cannot be used.
5. Measure and record the liquid line temperature ( $T_{\text{liquid}}$ ) in °F. This procedure is detailed in RA3.2.2.5. This value is used to calculate the measured subcool temperature.
6. Measure and record the liquid line pressure ( $P_{\text{liquid}}$ ) in psig. This procedure is detailed in RA3.2.2.5. This value is used to determine the condenser saturation temperature ( $T_{\text{condenser,sat}}$ ) from a pressure temperature chart for the appropriate refrigerant (can be internal to a digital gauge), which is entered into F07.
7. Enter the condenser saturation temperature ( $T_{\text{condenser,sat}}$ ) from the digital gauge or a separate pressure-temperature chart that corresponds to the liquid line pressure entered in F06, in °F.



8. Measured Subcooling is automatically calculated as the difference between the liquid line temperature (F05) and the condenser saturation temperature (F07)
9. Enter target subcooling from manufacturer. This may be a challenge to find for older equipment. Internet searches can sometimes result in archived equipment specifications for the equipment in question, or sometimes a very similar model. If the manufacturer's target cannot be found the Commission's Executive Director may provide additional guidance for compliance.
10. System passes Subcooling Method when F09 is within plus or minus 5°F of F08.

### Section G. Metering Device Verification

1. Measure and record the suction line temperature ( $T_{\text{suction}}$ ) in °F. This procedure is detailed in RA3.2.2.5. This value is used to calculate the measured superheat.
2. Measure and record the suction line pressure ( $P_{\text{suction}}$ ) in psig. This procedure is detailed in RA3.2.2.5. This value is used to determine the evaporator saturation temperature ( $T_{\text{evaporator,sat}}$ ) from a pressure temperature chart for the appropriate refrigerant (can be internal to a digital gauge), which is entered into G03.
3. Enter the evaporator saturation temperature ( $T_{\text{evaporator,sat}}$ ) from the digital gauge or a separate pressure-temperature chart that corresponds to the suction line pressure entered in G02, in °F.
4. Measured superheat is automatically calculated as the difference between the suction line temperature (G01) and the evaporator saturation temperature (G03)
5. There are two possible criteria for passing. If the manufacturer's specification is known it should be used, otherwise the CEC requirement is that the superheat be between 4°F and 25°F, inclusive. This row checks the CEC requirement.
6. If the manufacturer's target superheat for ensuring proper metering device operation is known, it supersedes the CEC requirement of being between 4°F and 25°F. If "Yes, documentation to be provided upon request." is selected, the installer should be prepared to provide documentation for the target values used.
7. There are two possible criteria for passing. If the manufacturer's specification is known it should be used, otherwise the CEC requirement is that the superheat be between 4°F and 25°F, inclusive. If "Yes, documentation to be provided upon request." is selected in G06, the installer should be prepared to provide documentation for the target values used.

### Section H. Confirmation of Refrigerant Pressure Differential

1. This field is automatically calculated based on the liquid line (high side) pressure and suction line (low side) pressure values previously entered. The protocols for the Winter Setup Method require that this pressure differential be between 160 psig and 220 psig, inclusive, for R-410a refrigerant; and between 100 psig and 145 psig, inclusive, for R-22 refrigerant. These procedures are detailed in Residential Appendix RA1.2.2.
2. This field is automatically calculated based on the liquid line (high side) pressure and suction line (low side) pressure values previously entered. The protocols for the Winter Setup Method require that this pressure differential be between 160 psig and 220 psig, inclusive, for R-410a refrigerant; and between 100 psig and 145 psig, inclusive, for R-22 refrigerant. These procedures are detailed in Residential Appendix RA1.2.2. If the pressure differential is not within the correct range, a statement will appear here that the system does not comply and the test will need to be redone using the appropriate procedures.

**Section I. Fault Indicator Display**

1. Enter the manufacturer name or make of the approved Fault Indicator Display. Must match name shown on the list of approved devices kept by the Commission.
2. Enter the manufacturer model number of the approved Fault Indicator Display. Must match name shown on the list of approved devices kept by the Commission.
3. The installer must confirm that the FID display module is mounted adjacent to thermostat that controls the system being verified. This requirement is detailed in Residential Appendix RA3.4.2.
4. The installer must confirm that the installed FID is approved and appears the list of approved devices kept by the Commission. This requirement is detailed in Residential Appendix RA3.4.2.
5. The installer must confirm that the system has operated for at least 15 minutes and that they system is operating within acceptable parameters as specified by the FID and equipment manufacturers. This requirement is detailed in Residential Appendix RA3.4.2.

**Section J. Fault Indicator Display – Additional Requirements**

1. Additional requirements are items that must be done, but are not specifically required to be checked by the HERS rater. By signing the Declaration Statement on this document, the installer is declaring that all of these additional requirements have been met. The requirement for installing FIDs to manufacturer's specifications (unless factory installed) can be found in Joint Appendix JA6.1.3.
2. Additional requirements are items that must be done, but are not specifically required to be checked by the HERS rater. By signing the Declaration Statement on this document, the installer is declaring that all of these additional requirements have been met. The requirement for providing manufacturer's instructions and other documentation for FIDs can be found in Joint Appendix JA6.1.4.

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