

# APPENDIX B:

## Eligibility Verification Protocols

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The procedures in this appendix shall be used in conjunction with applicable verification protocols published in the 2019 Residential Appendices to determine whether a VCHP system meets the eligibility requirements for the VCHP performance compliance option described in this report. Section SC3.4.4.3 below organizes and references all of the verification procedures required to demonstrate compliance with the eligibility requirements for a system. A Certificate of Installation and Certificate of Verification shall be registered with a California Title 24 Data Registry to document compliance with all verification procedures specified in SC3.4.4.3.

Two of the procedures in this appendix shall be applicable for systems that use the VCHP compliance option described in this report. The two procedures are:

- SC3.1.4.2.2 Nominal Air Handler Airflow
- SC3.3.3.4.1 Airflow Calculation (cfm/ton)

SC3.1.4.2.2 and SC3.3.3.4.1 shall be used in conjunction with current RA3 procedures to enable verification of system airflow rate and duct leakage for ducted multiple-split systems using this VCHP compliance option.

The procedures in this appendix shall be published on the residential special case compliance webpage at the following URL:

[Link to special case compliance webpage](#)

The procedures in this appendix are expected to be incorporated into the Residential Appendices during the next update to the CA Energy Code.

### **SC3.4.4.3 Variable Capacity Heat Pump Performance Compliance Option Eligibility Verification**

When a performance certificate of compliance indicates a space conditioning system requires verification of the variable capacity heat pump (VCHP) compliance option eligibility requirements, the installed VCHP system shall be field verified to confirm compliance with the eligibility requirements as specified in this section.

If field verification determines the VCHP does not comply with all eligibility requirements in this section, then the dwelling in which the VCHP is installed shall not be eligible to claim the VCHP performance compliance credit for that space conditioning system.

Compliance with Section 150.0(m)11 (Duct System Sealing and Leakage Testing) is not required for systems that use this VCHP performance compliance option, however there are requirements to verify that VCHP system indoor unit ducts are located entirely in conditioned space that are specified as eligibility requirements for this compliance option.

Compliance with Section 150.0(m)13 is not required for systems that use this VCHP performance compliance option, however there are requirements for verification of minimum airflow rates for VCHP system indoor units that are specified as eligibility requirements for this compliance option.

- (a) **Low-static system certification for ducted systems.** The manufacturer of ducted indoor units shall certify to the Energy Commission that the system is a VCHP that meets the definition of a low-static system as defined in 10 CFR Parts 429 and 430, Docket No. EERE–2016–BT–TP–0029, Federal Register Vol. 82, No. 3, January 5, 2017). The manufacturer's model number(s) shall be included in listings of certified-to-the-Energy Commission low-static pressure VCHP systems which will be published on the Energy Commission's website

If the installed VCHP system has ducted indoor units, then verification of the Energy Commission listings of certified VCHP systems shall confirm the installed system is included in the Energy Commission listings of certified low static systems.

If the VCHP model is not included in the Energy Commission listings of certified low static systems, then the system does not comply with the VCHP compliance option eligibility requirements.

- (b) **Non-continuous default fan operation certification for ducted systems.** The manufacturer may elect to certify to the Energy Commission that their ducted indoor unit + outdoor unit combination does not operate the indoor unit fan continuously by default. This certification is required in order to receive credit for the non-continuous fan operation component of the VCHP compliance option credit.

If the installed VCHP system has ducted indoor units, and the certificate of compliance indicates credit has been taken for non-continuous default fan operation, then visual inspection of the Energy Commission listings of certified VCHP systems shall confirm the installed system is included in the Energy Commission listings and the certification indicates the system is a type with indoor units that do not run the fan continuously during periods when there is no call for conditioning.

If the model is not included in the Energy Commission listings of certified low static systems as a type with indoor units that do not run the fan continuously during periods when there is no call for conditioning, then the system does not comply with the VCHP compliance option eligibility requirements.

A revised certificate of compliance may be submitted to the enforcement agency that does not specify credit for non-continuous default fan operation.

- (c) **Refrigerant charge verification.** The installed system shall have refrigerant charge verified in accordance with applicable procedures in RA3.2, as specified in Standards Sections 150.1(c)7A and 150.2(b)1Fii, or 150.2(b)1Fiii.

If the system does not meet the refrigerant charge verification requirements, then the system does not comply with the VCHP compliance option eligibility requirements.

- (d) **Low leakage ducts located entirely in conditioned space verification.** Ducted indoor units shall be verified in accordance with the Verified Low Leakage Ducts in Conditioned Space procedure in Section RA3.1.4.3.8.

If the system does not meet the RA3.1.4.3.8 requirements, then the system does not comply with the VCHP compliance option eligibility requirements.

- (e) **Ductless space conditioning system indoor units located entirely in conditioned space verification.** Ductless systems shall be verified in accordance

with the ductless space conditioning system indoor units located entirely in conditioned space procedure in SC3.1.4.1.8 to visually confirm ductless indoor units are located entirely in conditioned space.

If the system is not considered to be entirely in conditioned space according to SC3.1.4.1.8 requirements, then the system does not comply with the VCHP compliance option eligibility requirements.

- (f) **Space-Conditioning System Airflow Supply to All Habitable Spaces.** Field verification according to the procedure in SC3.1.4.1.7 shall confirm that airflow is supplied to all habitable spaces in a dwelling that specifies use of the VCHP compliance option.

If space conditioning system airflow is not supplied to all habitable spaces in the dwelling as determined by the procedure in SC3.1.4.1.7, then the system does not comply with the VCHP compliance option eligibility requirements.

- (g) **Wall mounted thermostat in zones > 150 ft<sup>2</sup>.** Field verification according to the procedure in SC3.4.5 shall confirm that VCHP space conditioning zones in the dwelling that are greater than 150 ft<sup>2</sup>, are controlled by a permanently installed wall-mounted thermostat.

If a zone area served by an indoor unit is greater than 150 ft<sup>2</sup>, and the indoor unit is not controlled by a permanently installed wall-mounted thermostat located in the zone served by the indoor unit as determined according to the procedure in SC3.4.5, then the system does not comply with the VCHP compliance option eligibility requirements.

- (h) **Non-continuous fan operation - field verification.** If non-continuous indoor unit fan operation is specified for improved compliance credit for ducted VCHP systems in the CBECC-Res model, and thus the certificate of compliance indicates field verification of non-continuous indoor unit fan operation is required, then the system shall be field verified in accordance with the procedures in SC3.4.6 to confirm that the installed system's indoor unit + outdoor unit combination does not operate the fan continuously when the system thermostat is not calling for conditioning.

If field verification according to SC3.4.6 determines the installed system's indoor unit + outdoor unit combination operates the fan continuously when the system thermostat is not calling for conditioning, then the system does not comply with the VCHP compliance option eligibility requirements.

A revised certificate of compliance may be submitted to the enforcement agency that does not specify credit for non-continuous default fan operation.

- (i) **Minimum airflow rate verification.** Each new ducted indoor unit shall have airflow verified in accordance with the procedures in RA3.3 to confirm the airflow at full capacity in cooling mode is equal to or greater than 350 cfm/ton of nominal cooling capacity. 300 cfm/ton shall be verified for altered systems if required for compliance with the refrigerant charge verification procedure.

For indoor units of single-split systems, the measured value for airflow in cfm shall be converted into cfm per ton by dividing the measured indoor unit airflow rate by the nominal tons of outdoor unit cooling capacity.

For indoor units of multiple-split systems, the measured value for airflow in cfm shall be converted into cfm per ton by dividing the measured indoor unit airflow rate by the nominal tons of indoor unit cooling capacity.

If the indoor unit does not meet or exceed the 350 cfm/ton minimum airflow rate required for new systems, or the 300 cfm/ton required for altered systems meeting the refrigerant charge minimum airflow rate, then the system does not comply with the VCHP compliance option eligibility requirements.

- (j) **Air filter sizing.** Ducted low-static VCHP indoor units with any length of duct shall have the air filters for the return air inlets verified to confirm the air filter sizing conforms to the procedures in i or ii below as applicable.
  - i. Nominal 2-inch or greater depth air filters shall be sized by the system designer to accommodate a maximum allowable clean-filter pressure drop of 0.1 inch wc at the air filter's design airflow rate. Field verification of the system designers sizing methodology shall not be required for nominal 2-inch or greater depth air filters, however verification that the installed 2-inch or greater depth air filter is rated to meet a clean filter pressure drop of less than or equal to 0.1 inch wc at the air filter's design airflow rate shall conform to the procedures in SC3.1.4.8.

If any of the indoor unit's applicable nominal 2-inch or greater depth air filters fails to meet the maximum 0.1 inch wc. clean filter pressure drop requirement as verified according to the procedure in SC3.1.4.8, then the system does not comply with the VCHP compliance option eligibility requirements.

- ii. Nominal one-inch minimum depth air filters shall be allowed if the filter face area is sized based on a maximum face velocity of 150 ft. per minute at the air filter design airflow rate according to the procedures in SC3.1.4.7.

All of the indoor unit air filters that are required to be sized and verified according to a face velocity specification shall comply, otherwise the indoor unit does not comply. If any of the indoor unit's applicable nominal 1-inch depth air filters has a face area less than the required face area determined according to the procedures in SC3.1.4.7, then the system does not comply with the VCHP compliance option eligibility requirements.

- (k) **Air filter maximum pressure drop.** Ducted low-static VCHP indoor units with any length of duct shall have the air filters for the return air inlets verified according to the procedures in SC3.1.4.8 to confirm the air filter is rated to provide a clean filter pressure drop less than or equal to 0.1 inch wc., at an airflow rate greater than or equal to the air filter's design airflow rate.

If verification of the indoor unit's air filters according to the procedures in SC3.1.4.8 determines that one or more of the air filters does not provide clean filter pressure drop less than or equal to 0.1 inch wc., at an airflow rate greater than or equal to the air filter's design airflow rate, then the system does not comply with the VCHP compliance option eligibility requirements.

### **SC3.1.4.1.7 Verification of Space-Conditioning System Airflow Supply to All Habitable Spaces**

A visual inspection shall confirm that all habitable spaces in the dwelling unit receive space-conditioning system airflow either by use of a ductless space-conditioning system indoor unit located on the wall, ceiling, or floor of the habitable space, or by use of space-conditioning system air supply registers located in the habitable space that use ductwork connected from the register directly to the supply air outlet of a ducted space-conditioning system air handling unit. Refer to Standards Section 100.1 for the definition of habitable space. Transfer fans that move air from one space in the dwelling to a different space in the dwelling, but do not heat or cool the air transferred, do not meet the requirement for providing space-conditioning system airflow.

#### **SC3.1.4.1.8 Verification of Ductless Space-Conditioning System Indoor Units Located Entirely in Conditioned Space**

A visual inspection shall confirm that ductless indoor units are located entirely in conditioned space in accordance with the following requirements:

- (a) Ductless indoor unit types that mount entirely on the interior surface of dwelling unit walls, ceilings, or floors shall be considered to be entirely in conditioned space. Penetrations in the wall, ceiling or floor surface necessary for the indoor unit refrigerant piping, condensate drain, or electrical connections shall be allowed, provided the penetrations are well sealed.
- (b) Ductless indoor units that penetrate the interior surface of dwelling unit walls, ceilings, or floors, and protrude through cut-out openings in the dwelling unit walls, ceilings, or floors shall be inspected to determine whether the indoor unit is installed inside both the thermal boundary and the air barrier of the dwelling as follows:
  - i. If the ductless indoor unit protrudes through the air barrier into unconditioned spaces such as attics, crawl spaces, garages, or outdoors, the indoor unit shall not be considered to be located entirely in conditioned space.
  - ii. If the indoor unit protrudes into indirectly conditioned spaces such as drop ceilings, or floor assemblies in a single family or multifamily multi-story building, that are wholly inside both the thermal boundary and the air barrier of the dwelling, then the unit shall be considered to be located entirely in conditioned space. Verification at an early stage of building construction may be necessary in order for this visual verification to be possible.

If field verification according to SC3.1.4.1.8 determines the installed system's ductless indoor units are not located entirely in conditioned space, then the system does not comply with the VCHP compliance option eligibility requirements.

#### **SC3.1.4.2.2 Nominal Air Handler Airflow**

- For heating-only systems the nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity.
- For cooling systems that are packaged systems, or split systems with only one indoor unit, the nominal air handler airflow shall be 350 CFM per nominal ton of outdoor condensing unit cooling capacity, otherwise the heating-only value, whichever is greater.

- For small duct high velocity systems, the nominal air handler airflow shall be 250 CFM per nominal ton of outdoor condensing unit cooling capacity.
- For multiple-split systems that provide cooling, the nominal air handler airflow for each indoor unit shall be 350 CFM per nominal ton of indoor unit cooling capacity.

### SC3.1.4.7 Verification of Air Filter Sizing According to Face Velocity Specification

When compliance requires verification that a ducted system's indoor unit air filters have been sized in accordance with a maximum face velocity specification, the following procedure shall be used.

- Indoor unit design airflow rate.** Record the design airflow rate for the indoor unit in CFM as specified by the system designer. The design airflow rate shall be equal to or greater than the minimum airflow rate required for compliance with the standards. Alternatively, if the design airflow rate for the indoor unit is not available, calculate and record the nominal air handler airflow rate for the indoor unit in accordance with the specifications in SC3.1.4.2.2.
- Air filter design airflow rate.** For indoor units with only one filtered return air inlet, the air filter design airflow rate in CFM is equal to the indoor unit design airflow rate determined in step (a). For indoor units with more than one filtered return air inlet, the system designer shall determine what portion of the total indoor unit airflow is equal to the air filter design airflow for each air filter, ensuring that the sum total of all individual air filter design airflow rates is equal to the total indoor unit design airflow rate determined in step (a).
- Air filter grille/rack sticker.** Standards Section 150.0(m)12Biv requires that air filter installation locations shall have the air filter design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate posted on a label/sticker, inside or near the location of the filter grille/rack such that this information will be visible to a person replacing the air filter.

Field inspection shall verify that each air filter installation location has the required sticker. If the air filter installation location does not have the required sticker, the indoor unit does not comply.

- Air filter maximum face velocity allowed.** Record the maximum allowable face velocity value in ft/min required for compliance for each air filter.
- Minimum air filter face area allowed.** For each air filter, divide the air filter design airflow rate in ft<sup>3</sup>/min by the maximum allowable face velocity in ft/min. The result is the minimum allowable total air filter face area in ft<sup>2</sup> for the air filter. Convert the calculated face area from square feet to square inches by multiplying the face area in square feet by 144.

Note: the air filter face area is the nominal area of the side of the air filter that is perpendicular to the direction of the airflow through the air filter.

- Installed air filter nominal dimensions.** Measure and record the installed nominal length dimension in inches and nominal width dimension in inches for the side of the

filter that is perpendicular to the direction of the airflow through the air filter installed in the return air grille/rack of the indoor unit. If there is more than one filtered return air inlet for the indoor unit, measure and record the length dimension and width dimension of each of the air filters.

- (g) **Installed air filter face area.** For each of the filtered return air inlets for the indoor unit, multiply the nominal air filter length dimension by the nominal air filter width dimension to calculate the nominal air filter face area in square inches.
- (h) **Determining compliance.** For each of the filtered return air inlets for the indoor unit, if the installed air filter face area is greater than or equal to the minimum air filter face area allowed as determined in step (e), then the air filter complies. All of the indoor unit air filters that are required be sized and verified according to a face velocity specification shall comply, otherwise the indoor unit does not comply.

### SC3.1.4.8 Verification of Air Filter Pressure Drop Rating

When compliance requires field verification to confirm that a ducted system's indoor unit air filter(s) comply with a minimum clean filter pressure drop requirement, the following steps shall be followed. When there is more than one filtered return air inlet for the indoor unit, all of the indoor unit's air filter devices shall be field verified.

- (a) **Indoor unit design airflow rate.** Record the design airflow rate for the indoor unit in CFM as specified by the system designer. The design airflow rate shall be equal to or greater than the minimum airflow rate required for compliance with the standards. Alternatively, if the design airflow rate for the indoor unit is not available, calculate and record the nominal air handler airflow rate for the indoor unit in accordance with the specifications in SC3.1.4.2.2.
- (b) **Air filter design airflow rate.** For indoor units with only one filtered return air inlet, the air filter design airflow rate in CFM is equal to the indoor unit design airflow rate determined in step (a). For indoor units with more than one filtered return air inlet, the system designer shall determine what portion of the total indoor unit airflow is equal to the air filter design airflow for each air filter, ensuring that the sum total of all individual air filter design airflow rates is equal to the total indoor unit design airflow rate determined in step (a).
- (c) **Air filter grille/rack sticker.** Standards Section 150.0(m)12Biv requires that air filter installation locations shall have the air filter design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate posted on a label/sticker, inside or near the location of the filter grille/rack such that this information will be visible to a person replacing the air filter.

Field inspection shall verify that each air filter installation location has the required sticker. If the air filter installation location does not have the required sticker, the indoor unit does not comply.

- (d) **Air filter manufacturer's performance rating label.** Standards section 150.0(m)12E requires that the air filter placed in the filter grille/rack shall be labeled by the air filter manufacturer to disclose the clean filter pressure drop performance determined according to ASHRAE Standard 52.2 or AHRI Standard 680. The required air

filter label information includes clean filter pressure drop ratings at a range of airflow rates.

Field inspection shall verify that the air filter installed in the filter grille/rack has the required performance rating label. If an installed air filter does not have the required manufacturer's performance rating label, then the indoor unit does not comply.

- (e) **Determining clean filter pressure drop compliance.** Inspection of the air filter manufacturer's performance rating label shall verify that the air filter is rated to provide a clean filter pressure drop less than or equal to the value required for compliance, at an airflow rate greater than or equal to the design airflow for the filter. Interpolation of the manufacturer's airflow and pressure drop rating values published on the air filter performance rating label is allowed when determining compliance. Field diagnostic pressure measurements of operating indoor units to determine the pressure drop of installed air filters are not required for demonstrating compliance.

If all of the indoor unit air filters are rated to operate at a pressure drop less than or equal to the value required for compliance, and at an airflow rate greater than or equal to the design airflow for the air filter, then the indoor unit complies.

#### **SC3.3.3.4.1 Airflow Calculation (cfm/ton)**

For packaged systems, and for split systems with only one indoor unit, the measured value for airflow (cfm) shall be converted to cfm per ton by dividing the measured system airflow rate by the nominal tons of outdoor condensing unit cooling capacity.

For indoor units of multiple-split systems, the measured value for airflow in cfm shall be converted into cfm per ton by dividing the measured indoor unit airflow rate by the nominal tons of indoor unit cooling coil capacity.

#### **SC3.4.5 Verification of Wall-Mounted Thermostat**

When compliance requires verification that a wall-mounted, thermostat has been installed to control a space conditioning system's indoor unit operation, the system's indoor unit thermostat(s) shall be verified according to the following procedures. If a system has more than one indoor unit, then all of the system's indoor unit thermostats shall be verified according to this procedure.

- (a) If the conditioned floor area (ft<sup>2</sup>) of the zone served by an indoor unit is not a criterion for determining the compliance requirement for wall-mounted thermostats, then skip to subsection (b) below.

Otherwise, if the conditioned floor area (ft<sup>2</sup>) of the zone served by an indoor unit is a criterion for determining the compliance requirements for wall-mounted thermostats in the zone, then record the conditioned floor area served by the indoor unit.

- i. If the zone area size (ft<sup>2</sup>) criterion indicates that a wall-mounted thermostat is not required for the zone, then the indoor unit complies and no further thermostat verification is required for the zone served by the indoor unit.
- ii. If the zone area size (ft<sup>2</sup>) criterion indicates that a wall-mounted thermostat is required for the zone, then perform the remaining steps that follow.



- (b) If possible, locate the wall-mounted thermostat that controls the indoor unit, and verify whether or not the thermostat controls the indoor unit by setting the thermostat to a cooling setpoint that is less than the room temperature, or alternatively by setting the thermostat to a heating setpoint that is greater than the room temperature.

If there is no wall-mounted thermostat installed in the zone that controls the indoor unit, then the indoor unit does not comply.

If there is a wall-mounted thermostat installed that controls the indoor unit, but it is not located within the zone served by the indoor unit, then the indoor unit does not comply.

- (c) For a wall-mounted thermostat installed in the zone that controls the indoor unit located in step (b), by visual inspection determine if the thermostat is mounted permanently to the wall. Wall-mounted brackets or other means that facilitate non-permanent attachment of handheld thermostats to the wall do not meet this requirement.

If the thermostat is not permanently mounted to the wall, then the indoor unit does not comply.

### **SC3.4.6 Verification of Non-Continuous Indoor Unit Fan Operation**

When compliance requires field verification that an installed space conditioning system indoor unit does not operate the air distribution fan during periods when the space does not require heating or cooling, the system's indoor unit operation shall be field verified according to the following procedures. If a system has more than one indoor unit, then all of the system's applicable indoor units shall be verified according to this procedure.

- (a) If possible, locate the manufacturer's indoor unit + outdoor unit combination in the Energy Commission listing of systems that have been certified by the manufacturer as systems that do not operate the air distribution fan during periods when the space does not require heating or cooling.

<https://www.energy.ca.gov/rules-and-regulations/building-energy-efficiency/manufacturing-certification-building-equipment>

Record the result of the search for the system model(s). If the manufacturer's indoor unit + outdoor unit combination is not included in the CEC listing, then the indoor unit does not comply.

- (b) Switch the system to heating mode.
- (c) Switch on the heating system by setting the thermostat to a setpoint that is greater than the room temperature.
- (d) Verify the thermostat activates the indoor unit airflow.
- (e) Switch off the heating system by setting the thermostat to a setpoint that is less than the room temperature.
- (f) Verify the indoor unit air circulation fan does not operate when the compressor is off, except for a fan overrun (fan off delay) of less than 10 minutes that may occur at the end of the compressor on cycle.
- (g) Switch the system to cooling mode.

- (h) Switch on the cooling system by setting the thermostat to a setpoint that is less than the room temperature.
- (i) Verify the thermostat activates the indoor unit airflow.
- (j) Switch off the cooling system by setting the thermostat to a setpoint that is greater than the room temperature.
- (k) Verify the indoor unit air circulation fan does not operate the indoor fan when the compressor is off, except for a fan overrun (fan off delay) of less than 10 minutes that may occur at the end of the compressor on cycle.

If the system does not operate the indoor unit air distribution fan(s) during periods when the spaces served by the system do not require heating or cooling to meet the thermostat setpoint, then the system complies.