High-Performance Measure Details

Measure Name
Cold Climate Variable Refrigerant Flow and Multi-Split Heat Pump

Use Category
SH – Cold Climate VRF and Multi-Split Heat Pump

Effective Date
November 9, 2026

Version
4

Measure Code
LM401

Measure Stage
Early Adoption & High Priority Data Collection

Table of Contents

High-Performance Measure Details....1
Technology Summary....1
Alignment with CEDA Program Goals....2
CEDA Inducement Requirements....3
Incremental Measure Cost....8
Code Readiness Objectives....10
Code Reference....12
Eligible Climate Zones, Building Types, and Project Scopes....13
Measure Exclusions....14
Reviewer Checklist....15
Version History Log....17

Technology Summary

Cold climate variable refrigerant flow (ccVRF) and **cold climate multi-split heat pump (ccMSHP)** systems are air-source heat pumps in which one or more outdoor units serve **two or more indoor units through a shared refrigerant circuit**. They use **variable-capacity, inverter-driven compressors** and refrigeration-cycle enhancements that hold heating capacity and efficiency at low outdoor temperatures. In CEDA projects, **multi-split heat pumps** below 65,000 Btu/h commonly serve **high-rise multifamily dwelling units** and small groups of zones, while **VRF systems** at or above 65,000 Btu/h serve **multifamily common areas** and **nonresidential** buildings with many independently controlled zones. Indoor units can be non-ducted, ducted, or a mix of both, and VRF systems are available with **heat recovery** for simultaneous heating and cooling. **Hybrid VRF** systems use refrigerant between the outdoor unit and a branch controller and a water loop from the branch controller to the indoor units, which keeps refrigerant out of occupied spaces.

Most California climate zones have moderate heating design temperatures, but cold-climate capability still matters. Systems that hold capacity at low temperatures can be sized to carry the full heating load without electric resistance backup, operate more efficiently at part load through the heating season, and help limit winter peak demand growth as space heating electrifies. These benefits are greatest in inland and mountain climate zones,

where design temperatures approach or fall below freezing. At higher elevations, heat pump capacity also drops by roughly 3–4% per 1,000 feet, which makes low-ambient capacity more important in mountain projects.

This HPM addresses four common gaps:

1. **Standard ratings do not show cold-weather performance.** IEER is a cooling metric, and AHRI 1230 heating ratings stop at 17°F. For VRF systems at or above 65,000 Btu/h, the cold climate COP criteria at 17°F are equal or nearly equal to the Title 24 minimums, so performance at **5°F** is what separates cold climate systems from standard ones.
2. **Electric resistance backup can run more than needed.** For nonresidential and multifamily buildings, Title 24 §110.2(b) sets the operating order of compressor and supplementary heat but does not set an outdoor temperature lockout.
3. **Cold climate listings are thin for larger systems.** The ENERGY STAR Cold Climate designation and the NEEP Cold Climate Air Source Heat Pump (ccASHP) Product List cover single-phase multi-split heat pumps below 65,000 Btu/h. The NEEP VRF category has very few listed products, and the ENERGY STAR Light Commercial HVAC Cold Climate criteria for VRF at or above 65,000 Btu/h do not include 5°F performance. No listing currently identifies cold climate three-phase systems below 65,000 Btu/h.
4. **The VRF rating basis has changed.** The 2023 update to AHRI 1230 changed IEER ratings, and federal minimum IEER levels based on the updated test procedure took effect January 1, 2024. For VRF at or above 65,000 Btu/h, the CEC directs enforcement agencies to apply the federal IEER minimums rather than the EER values in Title 24 Tables 110.2-F and 110.2-G.[1] The cold climate IEER criteria in use today were set before this update, so they are likely more stringent when applied to current ratings.

The most relevant rating and certification references are AHRI Standard 1230-2023 for VRF multi-split systems and AHRI Standard 210/240 for systems below 65,000 Btu/h; the federal test procedures in 10 CFR 431.96 and 10 CFR Part 430, Subpart B, Appendix M1, including the H42 low-ambient test at 5°F; the ENERGY STAR Program Requirements for Central Air Conditioners and Heat Pumps, Version 6.2, including its Cold Climate criteria; and the NEEP ccASHP Specification, Version 4.0, which includes a **VRF multi-split heat pump** category. NEEP's planned Version 5.0 revision addresses only the central heat pump category, so the Version 4.0 VRF criteria are expected to remain current.

Alignment with CEDA Program Goals

The **California Energy Design Assistance (CEDA)** program is a Market Support program intended to support the long-term success of California's nonresidential and high-rise multifamily new construction market by advancing decarbonization, accelerating adoption of emerging and high-performance technologies, informing future codes and standards, and helping project teams achieve deeper energy and operational performance. **High-Performance Measures (HPMs)** support these objectives by creating opportunities for projects to implement, evaluate, and build market experience with technologies and design practices that extend beyond conventional practice.

Projects seeking a CEDA HPM inducement must meet the applicable requirements identified in the following section. Where aligned with Code Readiness priorities, selected projects may also provide market, design, cost, operational, or metered performance information that can help inform future California Codes and Standards activities.

[1] CEC, Updated Guidance – Variable Refrigerant Flow Minimum Efficiency Requirements: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/energy-code-support-center/hvac-1

This measure supports **CEDA's Market Support** objectives by:

- **Increasing market demand** by giving project teams and owners a clear, criteria-based pathway for multi-split and VRF systems that can carry the full heating load in cold conditions. This encourages designs that use the heat pump as the primary heat source rather than relying on electric resistance backup.
- **Increasing market supply and delivery capability** by encouraging designers and contractors to specify cold climate VRF and multi-split systems with published low-temperature performance data, and to configure supplementary heat lockouts at startup.
- **Building market partnerships and knowledge** by aligning with the ENERGY STAR and NEEP cold climate criteria that programs and manufacturers already use, and by collecting feedback from designers, contractors, manufacturers, and verification staff on barriers to adoption.
- **Advancing innovation and accessibility** by supporting cold climate VRF and multi-split systems that use low-GWP refrigerants, including heat recovery VRF that moves heat between zones in multifamily and mixed-use buildings.
- **Supporting Code Readiness and future market transformation** by identifying projects that can provide field data on low-ambient performance, supplementary heat use, defrost behavior, and installed cost. This information can inform future Title 24, deemed measure, and test-procedure activity, including cold climate VRF criteria based on current AHRI 1230 ratings.

CEDA Inducement Requirements

This HPM provides a pathway for cold-climate-capable **VRF and multi-split heat pump systems** in CEDA-eligible nonresidential and high-rise multifamily new construction projects. Standard systems are selected and rated around moderate conditions and can lose much of their heating capacity as outdoor temperatures drop, which leads designs to rely on electric resistance backup. This HPM supports systems with **verified low-ambient performance** and controls that keep the compressor as the primary heat source.

Eligibility is based on recognized cold climate criteria. Each equipment category qualifies through one pathway in *Table 1*: the **ENERGY STAR Cold Climate designation** or the **NEEP ccASHP Product List** for single-phase multi-split heat pumps, **CEDA performance criteria** for three-phase systems below 65,000 Btu/h, and the **NEEP Version 4.0 VRF criteria**, including COP at 5°F, for VRF systems at or above 65,000 Btu/h. The qualifying listing or criteria are the HPM performance quantity. The IMC normalization quantity is **rated cooling capacity in tons**.

These criteria exceed federal minimum efficiencies and add heating performance requirements at **5°F** that are not part of federal or Title 24 requirements. The supplementary heat lockout in this HPM also goes beyond Title 24 §110.2(b), which sets the order of operation but not a lockout temperature.

The measure is technology-neutral: any compressor technology, compliant refrigerant, or system design that meets the applicable pathway qualifies. Project data on low-ambient performance and supplementary heat use can support Code Readiness learning. The HPM applies to new construction, including additions and alterations eligible for CEDA participation.

Measure Eligibility (ME) – All Projects

1. **Qualifying Scope**
   1.1. The project shall install one or more **air-source multi-split or VRF heat pump systems** providing space heating and cooling, in an equipment category and qualification pathway listed in *Table 1*.

Table 1. *Eligible Equipment Categories and Qualification Pathways*

Pathway	Equipment Category	Federal Definition	AHRI Standard	Qualifies By
MS-1	Multi-split heat pump: multi-split, multi-circuit, or multi-head mini-split, including single-phase VRF; non-ducted, ducted, or mixed; single-phase, below 65,000 Btu/h	10 CFR 430.2	210/240	ENERGY STAR Cold Climate designation or NEEP ccASHP Product List (HP category, multizone)
MS-2	Three-phase VRF or multi-split heat pump, below 65,000 Btu/h	10 CFR 431.92	210/240	CEDA performance criteria (§SDLR 1.2)
VRF-1	VRF multi-split heat pump, air-source, at or above 65,000 Btu/h, with or without heat recovery, including hybrid VRF	10 CFR 431.92	1230	NEEP ccASHP Specification, Version 4.0, VRF criteria (§SDLR 1.3)

Notes: Federal equipment class and electrical phase determine the pathway. Single-phase VRF systems below 65,000 Btu/h are certified as central air conditioning heat pumps and qualify under MS-1. ***Mixed*** *systems combine ducted and non-ducted indoor units on one outdoor unit.* ***Hybrid VRF*** *qualifies under VRF-1 (§ME 1.3).*

1.2. **Multi-split** means one or more outdoor units serving **two or more indoor units** through a **shared refrigerant circuit**, including multi-split, multi-circuit, multi-head mini-split, and VRF systems. A separate system-level controller is not required.
1.3. **Hybrid VRF** systems, which use a water loop between the branch controller and the indoor units, are eligible under VRF-1 when the system is **certified to AHRI 1230** as an air-source VRF heat pump and meets §SDLR 1.3.
1.4. The heat pump shall be the **primary space heating source** for the spaces it serves.
1.5. Each claimed system shall be assigned to **one pathway**, based on its federal equipment class, electrical phase, and rated cooling capacity.
1.6. Size category is based on the **AHRI-rated cooling capacity** of the system (outdoor unit or module combination), not the sum of connected indoor unit capacities.

2. **Rating and Certification**
   2.1. Each system shall be certified to the **AHRI standard** for its category (*Table 1*), with an AHRI Directory listing[2] that matches the installed outdoor unit or module combination and indoor unit type.
   2.2. MS-1: The AHRI listing shall show the **ENERGY STAR Cold Climate designation**, or the installed combination shall be listed on the **NEEP ccASHP Product List** (HP category, multizone configuration).[3] ENERGY STAR certification under the base (non-cold-climate) criteria is not required.[4]
   2.3. MS-2: The system shall meet the CEDA performance criteria in §SDLR 1.2.
   2.4. VRF-1: The system shall meet the NEEP Version 4.0 VRF criteria in §SDLR 1.3, shown by a NEEP ccASHP Product List listing (VRF category) or by AHRI-certified ratings plus manufacturer-published 5°F performance data.

[2] AHRI Directory of Certified Product Performance: https://www.ahridirectory.org/
[3] NEEP ccASHP Specification (Version 4.0) and Product List: https://neep.org/heating-electrification/ccashp-specification-product-list. Version 4.0 includes central heat pump (HP), VRF multi-split heat pump, PTHP, and SPVHP categories. NEEP's planned Version 5.0 revision addresses the HP category only.
[4] The ENERGY STAR Cold Climate criteria set their own HSPF2 and SEER2 floors and do not include the EER2 floor that applies to base ENERGY STAR certification. AHRI Directory listings report base certification and the Cold Climate designation as separate fields. ENERGY STAR key product criteria: https://www.energystar.gov/products/air_source_heat_pumps/key-product-criteria

3. **Performance Quantity**
   3.1. The HPM performance quantity is the qualifying cold climate listing (MS-1) or the criteria in §SDLR 1.2 (MS-2) and §SDLR 1.3 (VRF-1), summarized in *Table 2* and *Table 3*.
4. **Claim Pathway and Interaction with Other HPMs**
   4.1. Each system shall be claimed under either this HPM or an applicable **CA statewide deemed measure package**, not both, such as SWHC050 for ductless multi-split heat pumps in multifamily dwelling units. CEDA will confirm the claim pathway for each system during project review.
   4.2. VRF and multi-split systems that meet this HPM shall be claimed under this HPM rather than **DMG-NT-2** of the Heat Pump Deemed Measure Gap Pathway HPM. Systems that do not meet this HPM may be evaluated under DMG-NT-2.
   4.3. Occupancy-based controls for qualifying VRF indoor units may also be claimed under the **VRF Systems with Occupancy-Based Controls HPM**, which covers the controls only. The heat pump equipment shall not be claimed under more than one HPM.
5. **Eligible Project Types and Climate Zones**
   5.1. As defined in *Eligible Climate Zones, Building Types, and Project Scopes*.
6. **Code Compliance**
   6.1. All projects shall comply with the 2025 Title 24, Part 6 requirements, applicable federal efficiency standards, applicable federal and CARB refrigerant GWP regulations, and applicable local codes.
   6.2. HPM requirements are intended to be above code and do not replace code compliance obligations.

System Design Level Requirements (SDLR) – Single Tier

These requirements apply to new construction and to additions and alterations eligible for CEDA participation. The cold climate criteria are based on the ENERGY STAR Program Requirements for Central Air Conditioners and Heat Pumps, Version 6.2, and the NEEP ccASHP Specification, Version 4.0. The VRF-1 IEER and COP criteria at 47°F and 17°F match NEEP Version 4.0 and, below 240,000 Btu/h, the ENERGY STAR Light Commercial HVAC Version 4.0 Cold Climate criteria; the COP criteria at 5°F come from NEEP Version 4.0. The values in this memo govern eligibility; later changes to any source apply only through a documented HPM version revision. The MS-2 criteria, the heat recovery IEER adjustment, and the 30°F lockout threshold are **proposed CEDA criteria**; the lockout is consistent with the Single Zone Heat Pump with Smart Thermostat and Cold Climate Air Source Heat Pump HPMs.

1. **Cold Climate Performance**
   1.1. **MS-1:** Systems shall carry the ENERGY STAR Cold Climate designation in their AHRI Directory listing, or be listed on the NEEP ccASHP Product List (HP category, multizone configuration).
   1.2. **MS-2:** Three-phase systems shall meet all of the following, which mirror the ENERGY STAR Cold Climate criteria:
      1.2.1. **HSPF2 ≥ 8.5** for non-ducted systems (all indoor units non-ducted), or **HSPF2 ≥ 8.1** for ducted and mixed systems, with **SEER2 ≥ 15.2**, per AHRI 210/240 certified ratings;
      1.2.2. **COP ≥ 1.75 at 5°F** at maximum capacity; and
      1.2.3. heating capacity at 5°F **≥ 70%** of the nominal heating capacity at 47°F.
      1.2.4. 5°F performance shall be shown by AHRI-reported low-ambient test results where available, or by manufacturer-published extended performance data.
   1.3. **VRF-1:** Systems at or above 65,000 Btu/h shall meet all criteria in *Table 3* for their size category:
      1.3.1. **IEER**, per AHRI 1230 certified ratings. Systems with **heat recovery** may use IEER values **0.2 lower**, consistent with the federal and Title 24 treatment of heat recovery VRF;
      1.3.2. **COP at 47°F and 17°F** at rated capacity, per AHRI 1230 certified ratings; and
      1.3.3. **COP at 5°F** at maximum capacity, per §SDLR 1.4.
   1.4. COP at 5°F for VRF-1 shall be shown by a NEEP ccASHP Product List listing, or calculated from manufacturer-published extended performance data for the installed outdoor unit or module combination as heating capacity (Btu/h) ÷ [power input (kW) × 3,412] at **5°F outdoor dry-bulb** and

maximum capacity operation, at a 100% indoor unit combination ratio where data are published by ratio. Data that include defrost effects are acceptable.

Table 2. *Cold Climate Performance Criteria, Systems Below 65,000 Btu/h (Summary for Reference)*

Pathway and Configuration	HSPF2	SEER2	COP at 5°F	Capacity at 5°F (% of 47°F)
MS-1: ENERGY STAR Cold Climate (Version 6.2)				
Non-ducted	≥ 8.5	≥ 15.2	≥ 1.75	≥ 70%
Ducted or mixed	≥ 8.1	≥ 15.2	≥ 1.75	≥ 70%
MS-1: NEEP ccASHP Specification (Version 4.0), HP category, multizone				
Non-ducted	≥ 8.5	≥ 15	≥ 1.75 (max. capacity)	—
Ducted or mixed	≥ 7.7	≥ 14.3	≥ 1.75 (max. capacity)	—
MS-2: CEDA Performance Criteria (Three-Phase)				
Non-ducted	≥ 8.5	≥ 15.2	≥ 1.75 (max. capacity)	≥ 70%
Ducted or mixed	≥ 8.1	≥ 15.2	≥ 1.75 (max. capacity)	≥ 70%

Notes: ENERGY STAR measures COP and capacity at 5°F with the Appendix M1 H42 test and also requires a controls verification procedure. NEEP Version 4.0 groups mixed systems with ducted systems and requires a variable-capacity compressor for the HP category. For MS-1, the AHRI Directory or NEEP Product List listing, not this summary, determines eligibility.

Table 3. *VRF-1 Cold Climate Performance Criteria, Systems at or Above 65,000 Btu/h*

Cooling Capacity (Btu/h)	IEER	IEER, Heat Recovery	COP at 47°F (rated capacity)	COP at 17°F (rated capacity)	COP at 5°F (max. capacity)
≥ 65,000 and < 135,000	≥ 18.9	≥ 18.7	≥ 3.40	≥ 2.25	≥ 1.55
≥ 135,000 and < 240,000	≥ 18.0	≥ 17.8	≥ 3.25	≥ 2.07	≥ 1.50
≥ 240,000	≥ 17.0	≥ 16.8	≥ 3.20	≥ 2.05	≥ 1.45

Notes: Values are from the NEEP ccASHP Specification, Version 4.0, VRF category. Heat recovery IEER values are a proposed CEDA adjustment. For comparison, the federal minimums for VRF heat pumps without heat recovery are IEER 14.6, 13.9, and 12.7 and COP at 47°F of 3.3, 3.2, and 3.2 (10 CFR 431.97, Table 16), and Title 24 Table 110.2-G sets COP at 17°F of 2.25 (65,000 to < 135,000 Btu/h) and 2.05 (≥ 135,000 Btu/h).

2. Supplementary Heat Controls

2.1. Where supplementary electric resistance heat is installed in indoor units, air handlers, or zone heaters serving the spaces served by the system, it shall be locked out at outdoor air temperatures above **30°F**.

2.2. Above the lockout setpoint, supplementary heat may operate only for defrost tempering or in emergency or compressor-fault mode.

2.3. Where a compressor low-ambient cutoff can be configured, it shall be set at or below the lockout setpoint, so compressor heating remains available at every outdoor temperature where supplementary heat is locked out.

2.4. Where the heating design outdoor temperature is above the lockout setpoint, the system shall meet **100% of the design heating load** at that temperature without supplementary heat.

2.5. Drain pan, base pan, crankcase, and freeze-protection heaters are not supplementary heat under this section.

3. **Functional Verification**
   3.1. The supplementary heat lockout and compressor cutoff setpoints (where configurable) shall be set and recorded during startup, commissioning, or controls checkout.

Supporting Documentation Requirements (SDR)

Documentation already included in the project drawings, schedules, submittals, control sequences, Title 24 compliance documents, or cost estimate does not need to be duplicated. This section identifies the minimum information needed to verify the equipment category, the qualifying listing or criteria, and the supplementary heat controls.

1. **Construction Documents**
   1.1. Mechanical schedules and plans identifying each claimed system, including equipment tags, manufacturer, outdoor unit or module and indoor unit model numbers, rated cooling capacity, electrical phase, heat recovery (where applicable), indoor unit types (ducted or non-ducted), spaces served, and any supplementary heat.
2. **Equipment Certification and Listing**
   2.1. An AHRI Directory certificate for each installed system.
   2.2. MS-1: The AHRI certificate showing the ENERGY STAR Cold Climate designation, or the NEEP ccASHP Product List listing for the installed combination. An ENERGY STAR product finder listing is not required.
   2.3. MS-2: Manufacturer-published extended performance data showing heating capacity and COP at 5°F and nominal heating capacity at 47°F, unless these values appear on the AHRI certificate.
   2.4. VRF-1: The NEEP ccASHP Product List listing, or manufacturer-published extended performance data showing heating capacity and power input at 5°F at maximum capacity for the installed outdoor unit or module combination.
3. **Title 24 Compliance Documentation**
   3.1. The project's Title 24, Part 6 compliance documents applicable to the claimed equipment.
   3.2. Where §SDLR 2.4 applies, the design heating load and the system's heating capacity at the heating design temperature, as already shown in load calculations, equipment schedules, or selection data.
4. **Supplementary Heat Controls**
   4.1. Where supplementary heat is installed, a startup, commissioning, or controls checkout record, or a controls submittal, showing the lockout and compressor cutoff setpoints.
5. **Installation Verification**
   5.1. Nameplate photos showing model and serial numbers, or equivalent confirmation during CEDA verification, demonstrating that installed outdoor units match the submitted models.
6. **Cost Information**
   6.1. Equipment and installation cost information as available, such as itemized invoices, pay applications, schedules of values, or contractor estimates. Fully itemized invoices are not required.

Incremental Measure Cost

The Incremental Measure Cost (IMC) values below are **program calibration inputs** used to support CEDA inducement development and cost-cap screening. They represent normalized estimates of the incremental first cost of installing equipment that meets this HPM's requirements, relative to code-minimum equipment of the same type and capacity.

These values are intended for program planning and inducement calibration only. They are **not** contractor bids, project estimates, or reconciliation values, and actual project costs will vary with equipment selection, site conditions, and market factors.

IMC values are derived primarily from the cost data in CPUC-approved deemed measure packages, effective January 1, 2026. Systems below 65,000 Btu/h use the offering closest to the cold climate performance level for each equipment type, consistent with the Cold Climate Air Source Heat Pump HPM. VRF systems at or above 65,000 Btu/h start from the same SWHC013 commercial heat pump IMC used for DMG-NT-2 of the Heat Pump Deemed Measure Gap Pathway HPM and add the cost of the higher cold climate IEER, so VRF-1 values stay above DMG-NT-2 on a common basis. Values will be revisited as CEDA obtains participating-project cost data.

Base Case

The Base Case is a code-minimum heat pump system of the same type and capacity, meeting the federal minimum efficiency for its equipment class: **SEER2 14.3 and HSPF2 7.5** for single-phase split systems under 10 CFR 430.32(c); the 10 CFR 431.97, Table 19 minimums for three-phase systems below 65,000 Btu/h (**SEER2 13.4 and HSPF2 7.5** for VRF heat pumps); and, at or above 65,000 Btu/h, the 10 CFR 431.97, Table 16 minimums (**IEER 14.6, 13.9, and 12.7** and **COP at 47°F of 3.3, 3.2, and 3.2** without heat recovery) with the Title 24 Table 110.2-G COP at 17°F. Code-required controls, including those under Title 24 §110.2(b), are included and not counted as incremental cost. Because each system is claimed under either this HPM or a deemed package (§ME 4.1), the Base Case is code-minimum equipment, not a deemed-qualifying system.

Measure Case

The Measure Case is a system that qualifies through a pathway in *Table 1* and meets the System Design Level Requirements. Incremental cost is limited to the higher-performance equipment premium. Installation labor is assumed equal in both cases, consistent with the referenced deemed packages. Supplementary heat lockout setup is part of normal startup, and no additional commissioning scope is required by this HPM.

IMC Values and Normalization

IMC values are normalized to **$/ton of rated cooling capacity**. This unit matches the claim unit used by the referenced deemed packages and the AHRI-listed capacity, and it tracks the primary cost driver, since equipment price scales with capacity.

$$\textbf{IMC} = (\text{Measure Material} + \text{Measure Labor}) - (\text{Base Material} + \text{Base Labor})$$

Table 4. *Incremental Measure Cost by Equipment Type*

Offering	Unit	Base Material	Base Labor	Measure Material	Measure Labor	Full Measure Cost	IMC
MS-1/MS-2 non-ducted (SWHC050-08)	ton	$1,087	Equal[1]	$2,746	Equal[1]	—	**$1,659**
MS-1 ducted or mixed (SWHC049-08)	ton	$1,296	$470	$1,783	$470	$2,253	**$487**
MS-2 ducted or mixed (SWHC014-09 proxy[2])	ton	$1,354	$1,201	$1,703	$1,201	$2,904	**$349**
VRF-1, 65,000 to < 135,000 Btu/h (SWHC013-08 + SWHC046-06[3])	ton	$1,267	$736	$1,780	$736	$2,516	**$513**
VRF-1, 135,000 to < 240,000 Btu/h (SWHC013-08 + SWHC046-06[3])	ton	$1,248	$561	$1,749	$561	$2,309	**$501**
VRF-1, ≥ 240,000 Btu/h (SWHC013-08 + SWHC046-06[3])	ton	$939	$552	$1,487	$552	$2,039	**$548**

[1] *SWHC050 itemizes labor identically for base and measure cases.*

[2] *Proposed CEDA calibration assumption, consistent with the Cold Climate Air Source Heat Pump HPM. SWHC014-09 covers commercial unitary equipment below 65,000 Btu/h and is the closest three-phase equivalent.*

[3] SWHC013-08 tier 1 heat pump costs (the DMG-NT-2 basis), plus the SWHC046-06 cost-per-IEER increment from the DMG-NT-2 Table 2 IEER to the Table 3 IEER; proposed CEDA calibration assumption.

Values are rounded to the nearest dollar; IMC values are calculated from unrounded package costs.

Calculation basis: For systems below 65,000 Btu/h, the IMC is the difference between the published measure case and base case costs for the matching offering in the referenced deemed measure package. It follows that package's cost methodology and markups; see the referenced eTRM measure for details.

- **Non-ducted multi-split systems (MS-1 and MS-2)** use the SWHC050-08 tier 5 offering (SEER2 ≥ 17.8, HSPF2 ≥ 8.5), whose HSPF2 matches the Cold Climate non-ducted floor: ($905.16 − $358.28) × 2.41 × 1.259 = **$1,659/ton**, applying the package's contractor markup and overhead and profit factors. SWHC050 covers ductless multi-split and multi-head mini-split systems.
- **Ducted and mixed MS-1 systems** use the SWHC049-08 heat pump offering at SEER2 ≥ 16.9, HSPF2 ≥ 8.1, the first offering that meets the Cold Climate ducted floor: ($1,370.00 − $995.90) × 1.259 × 1.0335 = **$487/ton**, applying the package's overhead and profit and city cost index factors. Labor is $373.28 × 1.259 = $470/ton in both cases. Mixed systems use the ducted value, which is the lower of the two.
- **Ducted and mixed MS-2 systems** use the SWHC014-09 split offering at SEER2 ≥ 17.1: $1,703.10 − $1,354.19 = **$349/ton**, with labor of $1,200.75/ton in both cases. Non-ducted three-phase systems use the SWHC050-08 value.
- **VRF-1 systems** start from the SWHC013-08 tier 1 heat pump costs used for DMG-NT-2 at 65,000 Btu/h and above (offerings N, P, and R: **$368, $361, and $392/ton** by size). The SWHC046-06 measure material cost for IEER-rated commercial heat pumps from 65 to 134 kBtu/h, which rises **$51.90/ton per 1.0 IEER** (15.0 to 16.0 IEER), is then added for the step from the DMG-NT-2 IEER (Table 2 of the Heat Pump Deemed Measure Gap Pathway HPM) to the *Table 3* IEER for each size category, with labor unchanged: $368 + (18.9 − 16.1) × $51.90 = **$513/ton**; $361 + (18.0 − 15.3) × $51.90 = **$501/ton**; and $392 + (17.0 − 14.0) × $51.90

= **$548/ton**. Heat recovery systems use the same values. Because both HPMs share the SWHC013 basis, the VRF-1 IMC exceeds the DMG-NT-2 IMC by the cost of the added cold climate efficiency.

- The SWHC046 increment does not apply a contractor markup, and none of the referenced packages itemize the incremental cost of 5°F performance, so the VRF-1 values are likely conservative. Both will be revisited with participating-project cost data.

These values represent typical incremental costs for new construction, including additions and alterations eligible for CEDA participation. They are intended for **program inducement calibration**, not project-specific cost reconciliation.

Sources

IMC values are informed by publicly available deemed measure cost data, field demonstration cost data, and program experience, and are intended to reflect typical market conditions rather than project-specific pricing, including:

- eTRM SWHC049-08, *Ducted AC and HP HVAC Equipment, Residential* (2026): https://www.caetrm.com/measure/SWHC049/08/
- eTRM SWHC050-08, *Ductless Heat Pump, Residential* (2026): https://www.caetrm.com/measure/SWHC050/08/
- eTRM SWHC014-09, *Unitary Air-Cooled AC or HP, Under 65 kBtu/hr, Commercial* (2026): https://www.caetrm.com/measure/SWHC014/09/
- eTRM SWHC013-08, *Unitary Air-Cooled Air Conditioner, Over 65 kBtu/hr, Commercial* (2026): https://www.caetrm.com/measure/SWHC013/08/
- eTRM SWHC046-06, *Packaged Heat Pump Air Conditioner, Commercial, Fuel Substitution* (2026): https://www.caetrm.com/measure/SWHC046/06/
- 10 CFR 431.97, *Energy efficiency standards and their compliance dates*, used for VRF base case efficiency levels: https://www.ecfr.gov/current/title-10/part-431/section-431.97

Code Readiness Objectives

This measure supports CEDA's Code Readiness role by generating field evidence on how cold-climate-capable VRF and multi-split systems perform in California new construction. Most heating hours in California occur at moderate outdoor temperatures, yet winter peak demand and electric resistance backup remain concerns as space heating electrifies. Title 24, Part 6 sets the operating order of compressor and supplementary heat in nonresidential and multifamily buildings but not an outdoor temperature lockout, and VRF ratings do not report heating performance below 17°F. Project data can inform future code, deemed measure, and program decisions on both points.

Routine CEDA verification under this HPM is limited to the documentation in the *Supporting Documentation Requirements*. Deeper field monitoring applies **only** to projects **separately selected** for Code Readiness activities.

The objectives include the following:

- Compare field heating capacity and COP at low outdoor temperatures with rated and published values across climate zones and elevations, including Climate Zone 16.
- Characterize heat recovery and hybrid VRF operation, including the share of heating delivered by recovered heat during simultaneous heating and cooling.
- Quantify supplementary heat runtime and energy, and confirm that lockout and compressor cutoff setpoints persist after occupancy.
- Evaluate whether cold climate systems reduce annual energy use in moderate California climates compared with standard VRF and multi-split systems, through better part-load efficiency.

- Characterize defrost frequency and duration and their effect on delivered heating and comfort.
- Document design practice, including indoor-to-outdoor connection ratios and how often designs meet 100% of the design heating load without supplementary heat.
- Collect installed cost and contractor experience data, including with low-GWP refrigerants, to recalibrate IMC values and inform cold climate VRF criteria based on current AHRI 1230 ratings.

Code Readiness Site Monitoring

If selected for Code Readiness monitoring, equipment energy consumption and mechanical system performance may be monitored on-site for a period of **up to 12 months**. To support performance evaluation and data collection, projects shall provide reasonable access for the installation and operation of metering, sensors, and communication equipment.

Projects equipped with a Building Automation System (BAS), Energy Management System (EMS), or equivalent platform should enable integration of advanced metering devices through the existing system to facilitate data collection and remote access. For projects without a BAS or EMS, the Code Readiness team may install temporary stand-alone data loggers, sensors, and communication equipment as needed to monitor system performance for the duration of the monitoring period.

Instrumentation may be installed or supplemented, where necessary, to measure key system and equipment parameters sufficient to evaluate system performance and operational characteristics. All monitoring equipment will be **temporary** and installed in a manner that **minimizes disruption to normal building operations**. Monitored parameters are **not** HPM eligibility requirements.

Data Benefits

Collected data will help support:

- Field-based assumptions on low-ambient capacity and efficiency of VRF and multi-split systems for California climate zones and elevations.
- Evaluation of a supplementary heat lockout threshold for nonresidential and multifamily heat pumps in future Title 24 cycles.
- Future deemed measure development for VRF systems at or above 65,000 Btu/h, which currently have no CA statewide deemed measure package.
- Cold climate VRF criteria based on ratings under the updated AHRI 1230 test procedure.
- Recalibration of IMC values using participating-project cost data.

Sample Data Points

A sample set of data points is provided below for reference. This list will be re-developed for each project based on the available infrastructure and the needs of the monitoring effort.

Data Point	Unit	Additional Specifications
Minimum/Core Data Points		
Outdoor unit electric power and energy	kW, kWh	Each outdoor unit or module; 1- to 15-minute intervals
Indoor unit and fan power	kW	Sampled indoor units or total indoor unit circuit
Supplementary electric resistance heat power	kW	Separate current transducer on the heater circuit, where installed
Outdoor air dry-bulb temperature	°F	On-site sensor or equipment-reported value

Data Point	Unit	Additional Specifications
Operating mode	Heat / Cool / Heat Recovery / Defrost / Off	From the VRF controller, thermostat, or BAS
Zone air temperature and setpoint	°F	From zone controllers or sensors, sampled zones
Calculated/Derived Metrics		
Delivered heating and cooling capacity	Btu/h	Controller-reported estimate, or airflow × ΔT at sampled indoor units
Operational efficiency	COP / EER	Per interval, binned by outdoor temperature
Heat pump share of heating energy	%	Compressor versus supplementary heat
Part-load ratio	%	Delivered load versus rated capacity
Optional/Technology-Specific Data Points		
Defrost events and duration	count, min	From the controller or inferred from mode and power data
Refrigerant pressures and temperatures	psig, °F	From the VRF controller, where available
Simultaneous heating and cooling share	%	Heat recovery systems only
Configured lockout and cutoff setpoints	°F	From the controller or thermostat configuration

Code Reference

Applicable Codes and Standards

The table below identifies current federal and California regulatory requirements that may affect the Base Case or Measure Case for this HPM. Applicability varies by **equipment type, building type, and project scope**.

CODE	APPLICABLE CODE REFERENCE	EFFECTIVE DATE	CODE REVIEW DATE
CA Building Energy Efficiency Standards – Title 24, Part 6	**§110.2(b)**, controls for heat pumps with supplementary heaters; §110.2(c), thermostats	January 1, 2026	November 2026
CA Building Energy Efficiency Standards – Title 24, Part 6	**Table 110.2-G**, VRF air-cooled heat pumps, minimum efficiency, including COP at 17°F of 2.25 (65,000 to < 135,000 Btu/h) and 2.05 (≥ 135,000 Btu/h). Per CEC guidance, federal IEER minimums apply and Table 110.2-G EER values are not enforced at or above 65,000 Btu/h	January 1, 2026	November 2026
CA Building Energy Efficiency Standards – Title 24, Part 6	**§110.12** and **§120.2(b)**, demand responsive controls and zonal thermostatic controls	January 1, 2026	November 2026
CA Building Energy Efficiency Standards – Title 24, Part 6	**§140.4(g)**, electric resistance space heating (nonresidential prescriptive)	January 1, 2026	November 2026
CA Building Energy Efficiency Standards – Title 24, Part 6	**§160.3(c)**, heat pump controls in multifamily buildings	January 1, 2026	November 2026
CA Building Energy Efficiency Standards – Title 24, Part 6	**§141.0(b)2Cii**, Table 141.0-E-1, space-conditioning system requirements for alterations	January 1, 2026	November 2026
Federal Standards – 10 CFR Part 430	**§430.32(c)**, consumer central air conditioners and heat pumps under 65 kBtu/h, including single-phase multi-split and VRF systems (MS-1)	January 1, 2023	November 2026

CODE	APPLICABLE CODE REFERENCE	EFFECTIVE DATE	CODE REVIEW DATE
Federal Standards – 10 CFR Part 430	**§430.23(m)** and Subpart B, Appendix M1, SEER2/HSPF2 test procedure, including the H42 low-ambient test at 5°F	July 7, 2025	November 2026
Federal Standards – 10 CFR Part 431	**§431.97(i)**, Table 19, three-phase small VRF multi-split systems under 65 kBtu/h (MS-2)	January 1, 2025	November 2026
Federal Standards – 10 CFR Part 431	**§431.97(g)(2)**, Table 16, VRF multi-split heat pumps at or above 65 kBtu/h (VRF-1), rated under the §431.96 test procedure (AHRI 1230)	January 1, 2024	November 2026
Federal Refrigerant Regulations – 40 CFR Part 84	**§84.54(c)(1)**, GWP limit of 700 for residential and light commercial AC and HP systems other than VRF. Systems with all components manufactured or imported before January 1, 2025 may continue to be installed (91 FR 31284)	January 1, 2025 (amended July 27, 2026)	November 2026
Federal Refrigerant Regulations – 40 CFR Part 84	**§84.54(c)(2)**, GWP limit of 700 for new VRF systems. Systems with all components manufactured or imported before January 1, 2026 may be installed until January 1, 2027, or until January 1, 2028 in buildings with a building permit approved before October 5, 2023	January 1, 2026 (amended December 12, 2024)	November 2026
CARB Refrigerant Regulations – 17 CCR	**§95374**, Table 3, GWP limit of 750 for new air-conditioning equipment and new VRF systems	January 1, 2025 (AC); January 1, 2026 (VRF)	November 2026

Note: The ENERGY STAR Program Requirements for Central Air Conditioners and Heat Pumps, Version 6.2, the ENERGY STAR Light Commercial HVAC specification, Version 4.0, and the NEEP ccASHP Specification, Version 4.0, are voluntary specifications. This HPM references them as the performance basis for eligibility, not as code requirements. Newer versions, including NEEP Version 5.0 for central heat pumps and any update to the ENERGY STAR or NEEP VRF criteria, apply only through a documented HPM revision.

Eligible Climate Zones, Building Types, and Project Scopes

Eligible Climate Zones

This high-performance measure applies statewide in **California Climate Zones 1–16** (Title 24). Projects in Climate Zones 5, 11, 13, 14, and 16 are of particular interest for Code Readiness data collection. Climate zone is confirmed from the project's Title 24 compliance documentation.

Eligible Building Types

This high-performance measure applies to:

- **High-Rise Multifamily:** buildings with four (4) or more habitable stories above grade, including dwelling units and common areas.
- **Nonresidential:** commercial, public, agricultural, and industrial facilities where multi-split or VRF systems serve multiple zones (e.g., offices, classrooms, lodging, healthcare, and mixed-use buildings).

Eligibility is based on the **qualifying equipment and pathway** (*Table 1*), not on building type alone.

Eligible Project Scopes

This high-performance measure applies to:

- **New construction**, including **additions and alterations eligible for CEDA participation**, which are covered under the same requirements as new construction.

This high-performance measure does not apply to (not in scope):

- **Low-rise residential** (single-family and multifamily with three or fewer habitable stories above grade).
- **Equipment replacement** projects that do not meet CEDA participation eligibility.

Measure Exclusions

The following are **not** eligible under this HPM:

1. Systems that do not qualify through a pathway in *Table 1*, such as single-phase multi-split systems without the ENERGY STAR Cold Climate designation or a NEEP listing, three-phase systems that do not meet §SDLR 1.2, and VRF systems without verifiable COP at 5°F that meets *Table 3*.
2. **Single-zone systems**, in which each outdoor unit serves one indoor unit, including collections of independent single-zone mini-splits, packaged units, PTHPs, and SPVHPs.
3. **Water-source and ground-source VRF**, hybrid VRF systems that are not certified to AHRI 1230 as air-source VRF heat pumps, water-to-water and air-to-water heat pumps, and heat pumps used primarily for process heating or service water heating.
4. **Non-heat-pump equipment**, including VRF and multi-split air conditioners without heat pump operation, fuel-fired equipment, and electric resistance heating equipment.
5. Systems claimed under a **CA statewide deemed measure package**. Each system is claimed under either a deemed package or this HPM, not both (§ME 4.1).
6. Equipment claimed under another CEDA HPM, including **DMG-NT-2** of the Heat Pump Deemed Measure Gap Pathway HPM and the **Cold Climate Air Source Heat Pump HPM**. Controls-only claims under the VRF Systems with Occupancy-Based Controls HPM are permitted as described in §ME 4.3.
7. Minor maintenance, like-for-like equipment replacement, and projects outside CEDA participation eligibility.
8. Systems that cannot be documented with the information required in the Supporting Documentation Requirements.
9. **Double counting.** The same recovered energy, incremental cost, or performance benefit shall not be claimed under more than one CEDA HPM.

Exclusion from this HPM does not necessarily mean exclusion from other CEDA offerings. Single-zone systems may be evaluated under the Cold Climate Air Source Heat Pump HPM, VRF and multi-split systems that do not meet this HPM may be evaluated under DMG-NT-2 of the Heat Pump Deemed Measure Gap Pathway HPM, and water-source VRF may be evaluated under the Extended-Range Water-Source Heat Pump and VRF Systems with Decoupled Ventilation and Heat Recovery HPM, as applicable.

CEDA program administrators reserve the right to determine whether claimed measures constitute overlapping scope for the same equipment, controls integration, or monitoring infrastructure.

Reviewer Checklist

HPM Reviewer Checklist: LM401 – Cold Climate VRF and Multi-Split Heat Pump – V4

Checklist Description: This checklist captures the minimum design and post-installation elements used to confirm HPM inducement eligibility and identify projects for optional Code Readiness monitoring.

Project Name: _____ **Review Date:** _____

Assessment:

☐ Approved
☐ Not approved

Notes:

Reviewer: _____ **Signature:** _____

Reviewer Checklist – High-Performance Measure Requirements

Use this checklist to confirm that the submitted project scope, design documents, and supporting documentation demonstrate compliance with this HPM. Review only the items applicable to the claimed scope.

Project Eligibility

☐ Nonresidential or high-rise multifamily (**4+ habitable stories**) new construction, including CEDA-eligible additions and alterations (§ME 5; *Eligible Project Scopes*)

☐ Climate zone confirmed from Title 24 documents (*Eligible Climate Zones*)

Qualifying System Scope

☐ **Multi-split or VRF** system: outdoor unit(s) serving **two or more indoor units** on a shared refrigerant circuit; air-source, not water-source; hybrid VRF only if AHRI 1230 certified (§ME 1.1–1.3; Excl. 2–4)

☐ Assigned to **one pathway** by federal equipment class, electrical phase, and AHRI-rated cooling capacity (§ME 1.5–1.6; *Table 1*)

☐ Heat pump is the **primary space heating source** for the spaces served (§ME 1.4)

☐ System is not claimed under a deemed measure package, DMG-NT-2, or another CEDA HPM; VRF occupancy-based controls claims allowed (§ME 4.1–4.3; Excl. 5, 6)

Cold Climate Performance (select one per system)

☐ AHRI listing matches the installed outdoor unit or module combination and indoor unit type (§ME 2.1)

☐ **MS-1** (single-phase, below 65 kBtu/h): ENERGY STAR Cold Climate designation on the AHRI listing or listed on the NEEP ccASHP Product List; base ENERGY STAR certification not required (§ME 2.2; §SDLR 1.1)

☐ **MS-2** (three-phase, below 65 kBtu/h): HSPF2 ≥ 8.5 non-ducted or ≥ 8.1 ducted/mixed, SEER2 ≥ 15.2, COP ≥ 1.75 and ≥ 70% capacity at 5°F (§SDLR 1.2)

☐ **VRF-1** (65 kBtu/h and above): IEER, COP at 47°F, and COP at 17°F meet *Table 3* per AHRI 1230 ratings; heat recovery IEER values used only for heat recovery systems (§SDLR 1.3.1–1.3.2)

☐ **VRF-1:** COP at 5°F at maximum capacity meets *Table 3*, from a NEEP listing or manufacturer extended performance data (§SDLR 1.3.3, 1.4)

Supplementary Heat Controls (where supplementary heat is installed)

☐ Supplementary heat locked out above **30°F**, except defrost tempering or emergency/compressor-fault mode (§SDLR 2.1–2.2)

HPM Reviewer Checklist: LM401 – Cold Climate VRF and Multi-Split Heat Pump – V4

☐ Compressor cutoff set at or below the lockout setpoint, where configurable (§SDLR 2.3)

☐ System meets **100% of the design heating load** where the design temperature is above the lockout setpoint (§SDLR 2.4)

☐ Lockout and cutoff setpoints recorded at startup, commissioning, or controls checkout (§SDLR 3.1)

Code and Scope Coordination

☐ Complies with Title 24, federal efficiency standards, and refrigerant GWP regulations (§ME 6.1)

☐ Normalization quantity recorded: **rated cooling tons** per system and pathway

Supporting Documentation

☐ Schedules and plans showing tags, models, capacity, electrical phase, heat recovery, indoor unit types, spaces served, and supplementary heat (§SDR 1)

☐ AHRI certificate, plus the qualifying ENERGY STAR or NEEP listing (MS-1) or 5°F performance data (MS-2, VRF-1) (§SDR 2)

☐ Title 24 compliance documents, plus design heating load and capacity where §SDLR 2.4 applies (§SDR 3)

☐ Lockout and cutoff setpoint record or controls submittal, where supplementary heat is installed (§SDR 4)

☐ Installed outdoor units match the submittals, by nameplate photos or CEDA verification (§SDR 5)

☐ Cost information, as available (§SDR 6)

Note: Deeper trend logging or metering is required only if the project is separately selected for Code Readiness monitoring.

Version History Log

Version	Effective Date	End Date	Change Description
1	January 17, 2024	May 15, 2024	Original memo with AAHP and VRF together.
2	May 16, 2024	February 08, 2026	Split VRF systems into its own memo.
3	February 09, 2026	November 8, 2026	Updated format, established Essential/Premium tier requirements and supporting documentation; added incremental cost, updated code references, added eligibility/exclusions and created reviewer checklist.
4	November 9, 2026	Active	Renamed the measure to include multi-split heat pumps and consolidated the tiers into a single tier. Single-phase systems below 65,000 Btu/h now qualify with the ENERGY STAR Cold Climate designation or a NEEP ccASHP Product List listing, three-phase systems below 65,000 Btu/h through CEDA performance criteria, and VRF systems at or above 65,000 Btu/h through the NEEP Version 4.0 VRF criteria, including COP at 5°F. Defined multi-split scope by shared refrigerant circuit and made hybrid VRF certified to AHRI 1230 eligible; added a supplementary heat lockout, a heat recovery IEER adjustment, and deemed and DMG-NT-2 claim-pathway language; removed the demand response and trend-logging requirements; rebased the IMC on eTRM cost data; and updated to the current memo format.

***Note**: The version identified as 'Active' is the current published version and remains in effect until superseded by a subsequent published version. CEDA may update, replace, or retire High-Performance Measures without prior notice. End dates are assigned to prior versions once superseded.*