



ENERGY STAR® Program Requirements Product Specification for Heat Pump Equipment

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for residential heat pumps (HPs). A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by the EPA for residential HPs. As part of this certification process, products must be tested in a laboratory recognized by the EPA to perform residential HP testing. A list of EPA-recognized laboratories and Certification Bodies can be found at www.energystar.gov/testingandverification.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the U.S. and/or ENERGY STAR partner countries.
5. Provide clear and consistent labeling of ENERGY STAR qualified residential HPs.
 - 5.1. The ENERGY STAR mark must be clearly displayed in product literature (i.e., user manuals, spec sheets, etc.) and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.
 - 5.1.1. For HPs meeting the standard ENERGY STAR criteria: the ENERGY STAR certification mark;
 - 5.1.2. For HPs meeting the Cold Climate criteria: the ENERGY STAR Cold Climate certification mark.
 - 5.2. It is also recommended that the mark appear on the product packaging.
 - 5.3. Partner shall adhere to the following product-specific commitments regarding use of the ENERGY STAR marks on qualified products:
 - 5.3.1. Whenever any of the ENERGY STAR marks are used in connection with a qualifying product in advertising, on specification sheets, on marketing materials, and on manufacturer's Internet site, provide the following disclaimer language: "Proper sizing and installation of equipment is critical to achieve optimal performance. Split system air conditioners and heat pumps (excluding ductless systems) must be matched with appropriate coil components to meet ENERGY STAR criteria. Ask your contractor for details or visit www.energystar.gov."

- 5.3.2. Provide detailed information in installation manuals that stresses the importance of proper installation. This information should be written for the equipment installer and should include the following paragraph.

For Package Units:

IMPORTANT – This product has been designed and manufactured to meet ENERGY STAR criteria for energy efficiency. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow the manufacturer’s refrigerant charging and air flow instructions. **Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.**

For Split-System Units:

IMPORTANT - This product has been designed and manufactured to meet ENERGY STAR criteria for energy efficiency when matched with appropriate coil components. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow the manufacturer’s refrigerant charging and air flow instructions. **Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.**

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by the EPA for residential HPs, providing full cooperation and timely responses. The EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government’s request.

Providing Information to the EPA

7. Provide unit shipment data or other market indicators to the EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
- 7.1. Partner must submit the total number of ENERGY STAR qualified residential HPs shipped in the calendar year or an equivalent measurement as agreed to in advance by the EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
 - 7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by the EPA.
 - 7.3. Partner must submit unit shipment data for each calendar year to the EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by the EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), the EPA will argue that the data is exempt. Any information used will be masked by the EPA so as to protect the confidentiality of the Partner.

8. Report to the EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. Notify the EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Training and Consumer Education

10. Partner shall comply with the following, product-specific requirements concerning training and education:
- 10.1. Offer and encourage training to distributors and/or contractors on the following issues: air distribution issues and their effect on equipment performance, refrigerant charging, proper installation of registers, duct work,

and plenum to ensure low leakage and to meet insulation requirements, and proper use of the Manual J calculation, or other equivalent calculation, in order to encourage proper sizing of equipment.

Performance for Special Distinction

In order to receive additional recognition and/or support from the EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep the EPA informed on the progress of these efforts:

- Provide quarterly, written updates to the EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to the EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), the EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to the EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, the EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like the EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with the EPA on one print advertorial and one live press event.
- Join the EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join the EPA's Green Power Partnership. The EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel- based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR® Program Requirements Product Specification for Heat Pump Equipment

Eligibility Criteria Version 6.2

Following is the Version 6.2 product specification for ENERGY STAR certified central air conditioner and heat pump equipment. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1) **Definitions:** Below are the definitions of the relevant terms in this document.

- A. Central Air Conditioning Heat Pump (HP)¹: A product, other than a packaged terminal heat pump, which is powered by single phase electric current, air cooled, rated below 65,000 Btu per hour, not contained within the same cabinet as a furnace, the rated capacity of which is above 225,000 Btu per hour, and is a heat pump unit only.

A central air conditioning heat pump may consist of: A single-package unit; an outdoor unit and one or more indoor units; an indoor unit only; or an outdoor unit with no match. In the case of an indoor unit only or an outdoor unit with no match, the unit must be tested and rated as a system (combination of both an indoor and an outdoor unit).

- B. Single-package unit²: Any heat pump that has all major assemblies enclosed in one cabinet.
- C. Split System²: Any heat pump that has at least two separate assemblies that are connected with refrigerant piping when installed. One of these assemblies includes an indoor coil that exchanges heat with the indoor air to provide heating or cooling, while one of the others includes an outdoor coil that exchanges heat with the outdoor air. Split systems may be either blower coil systems or coil-only systems.
- D. Multi-head mini-split system²: A split system that has one outdoor unit and that has two or more indoor units connected with a single refrigeration circuit. The indoor units operate in unison in response to a single indoor thermostat.
- E. Multiple-split (or multi-split) system²: A split system that has one outdoor unit and two or more coil-only indoor units and/or blower coil indoor units connected with a single refrigerant circuit. The indoor units operate independently and can condition multiple zones in response to at least two indoor thermostats or temperature sensors. The outdoor unit operates in response to independent operation of the indoor units based on control input of multiple indoor thermostats or temperature sensors, and/or based on refrigeration circuit sensor input (e.g., suction pressure).
- F. Ducted System²: A heat pump that is designed to be permanently installed equipment and delivers conditioned air to the indoor space through a duct(s). The heat pump may be either a split-system or a single-package unit. A ducted system may be any one of the following configurations:
- a. Ceiling-mount blower coil system²: A split system for which a) the outdoor unit has a certified cooling capacity less than or equal to 36,000 Btu/h; b) the indoor unit(s) is/are shipped with manufacturer-supplied installation instructions that specify to secure the indoor unit only to the ceiling, within a furred-down

¹ 10 CFR part 430, Subpart A, § 430.2 Definitions

² 10 CFR part 430, Subpart B, Appendix M1

space, or above a dropped ceiling of the conditioned space, with return air directly to the bottom of the unit without ductwork, or through the furred-down space, or optional insulated return air plenum that is shipped with the indoor unit; c) the installed height of the indoor unit is no more than 12 inches (not including condensate drain lines) and the installed depth (in the direction of airflow) of the indoor unit is no more than 30 inches; and d) supply air is discharged horizontally.

- b. Low-static blower coil system²: A ducted multi-split or multi-head mini-split system for which all indoor units produce greater than 0.01 in. wc. and a maximum of 0.35 in. wc. external static pressure when operated at the cooling full-load air volume rate not exceeding 400 cfm per rated ton of cooling.
 - c. Mid-static blower coil system²: A ducted multi-split or multi-head mini-split system for which all indoor units produce greater than 0.20 in. wc. and a maximum of 0.65 in. wc. when operated at the cooling full-load air volume rate not exceeding 400 cfm per rated ton of cooling.
 - d. Mobile home blower coil system²: A split system that contains an outdoor unit and an indoor unit that meet the following criteria:
 - i. Both the indoor and outdoor unit are shipped with manufacturer-supplied installation instructions that specify installation only in a mobile home with the home and equipment complying with HUD Manufactured Home Construction Safety Standard 24 CFR part 3280;
 - ii. The indoor unit cannot exceed 0.40 in. wc. when operated at the cooling full-load air volume rate not exceeding 400 cfm per rated ton of cooling; and
 - iii. The indoor and outdoor unit each must bear a label in at least 1/4 inch font that reads “For installation only in HUD manufactured home per Construction Safety Standard 24 CFR part 3280.”
 - e. Small-duct, high-velocity system²: A split system for which all indoor units are blower coil indoor units that produce at least 1.2 inches (of water column) of external static pressure when operated at the full-load air volume rate certified by the manufacturer of at least 220 scfm per rated ton of cooling.
 - f. Conventional ducted system²: All ducted heat pumps not otherwise listed above³, tested at a minimum external static pressure of 0.50 in. wc.
- G. Non-ducted Indoor Unit²: An indoor unit that is designed to be permanently installed, mounted on room walls and/or ceilings, and that directly heats or cools air within the conditioned space.
- H. Gas/Electric Package Unit: A single package unit with gas heating and electric air conditioning that is often installed on a slab or roof.
- I. Basic Model¹: All units of a given type of covered product (or class thereof) manufactured by one manufacturer and which have the same primary energy source and, which have essentially identical electrical, physical, or functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption or water efficiency.
- J. Heating Seasonal Performance Factor 2 (HSPF2)⁴: HSPF2 is the total space heating required in region IV during the space heating season, expressed in Btu, divided by the total electrical energy consumed by the heat pump system during the same season, expressed in watt-hours. The represented value of HSPF

³ One-to-one “mini-split” systems are categorized as either a non-ducted system (when testing without ductwork at 0 ESP) or as a conventional ducted system (when tested with ductwork at 0.50 in. wc). No categorization exists allowing mini-split systems to be tested at reduced external static pressures in a ducted configuration.

⁴ Based on definition in 10 CFR part 430, Subpart B, Appendix M and M1

determined in accordance with Appendix M1 is HSPF2, and the represented value in accordance with Appendix M is HSPF.

- K. Seasonal Energy Efficiency Ratio 2 (SEER2)⁴: SEER2 is the total heat removed from the conditioned space during the annual cooling season, expressed in Btu, divided by the total electrical energy consumed by the heat pump during the same season, expressed in watt-hours. The represented value determined in accordance with Appendix M1 is SEER2, and the represented value in accordance with Appendix M is SEER.
- L. Energy Efficiency Ratio 2 (EER2)⁴: EER2 is the ratio of the average rate of space cooling delivered to the average rate of electrical energy consumed by the heat pump. This ratio is expressed in Btu per Wh (Btu/Wh). The represented value determined in accordance with appendix M1 is EER2, and the represented value determined in accordance with Appendix M is EER.
- M. Coefficient of Performance (COP)²: COP means the ratio of the average rate of space heating delivered to the average rate of electrical energy consumed by the heat pump. These rate quantities must be determined from a single test or, if derived via interpolation, must be determined at a single set of operating conditions. COP is a dimensionless quantity.
- N. Percentage of Heating Capacity @ 5°F: The heating capacity of a given unit at 5°F, divided by the heating capacity at 47°F, expressed as a percentage.
- O. Independent Coil Manufacturer (ICM)²: A manufacturer that manufactures only the indoor unit (coil) in a Air-Source Heat Pump Split System.
- P. System Manufacturer (SM): A manufacturer that manufactures all the major assemblies in an Air- Source Unitary Heat Pump.

2) Scope:

- A. Included Products: Single package, split system, and gas/electric package units that meet the definitions of a heat pump as specified herein are eligible for ENERGY STAR certification, with the exception of products listed in Section 2.B. Units may be intended for installation into a duct system or may be ductless.
- B. Excluded Products: Three phase heat pumps, and products rated at 65,000 Btu/h or above are covered in the [ENERGY STAR Light Commercial HVAC specification](#). Ground Source Heat Pumps are covered under the [ENERGY STAR Geothermal Heat Pump specification](#).

3) Certification Criteria:

- A. Climates: ENERGY STAR HPs that are optimized for peak heating and part-load cooling performance may use the Cold Climate certification mark if certified to meet the cold climate criteria. All other HPs may use the standard ENERGY STAR certification mark.
- B. Energy Efficiency Requirements:
 - a. Certification Metric Criteria

Table 1: Energy-Efficiency Criteria for Certified Residential Heat Pumps

Product Type	SEER2	EER2	HSPF2
HP Split Systems	≥ 15.2	≥ 11.0	≥ 7.8
HP Single Package Equipment ¹	≥ 15.2	≥ 10.0	≥ 7.2

1. Including gas/electric package heat pumps, which are not eligible for the Cold Climate designation.

- i. For purposes of ENERGY STAR certification, a HP model may be designated as Cold Climate as per the associated requirements in Table 3.

Table 2: Energy-Efficiency Criteria for Certified Residential Cold Climate Heat Pumps

Product Type	SEER2	HSPF2
HP Split Systems (Non-Ducted)	≥ 15.2	≥ 8.5
HP Split Systems (Ducted)	≥ 15.2	≥ 8.1
HP Single Package Equipment ¹	≥ 15.2	≥ 8.1

1. Excludes gas/electric package heat pumps, which are not eligible for the Cold Climate designation.

- ii. Cold Climate HPs Low Ambient Performance: To earn the Cold Climate designation, HPs must demonstrate low ambient performance by meeting the following:
 - COP at 5°F ≥ 1.75, measured in accordance with Appendix M1⁵ H4₂ test.
 - Percent of Heating Capacity at 5°F ≥ 70% of that at 47°F, with the 5°F capacity measured per Appendix M1 H4₂ test and the 47°F capacity measured as the nominal heating capacity per Appendix M1 (*i.e.*, from the Appendix M1 H1_N test for units having a variable-speed compressor where the compressor speed shall be the maximum speed that the system controls would operate at 47°F, otherwise from the Appendix M1 H1₂ test).
 - Perform a controls verification procedure (CVP) to confirm that the above performance metrics measured at the Appendix M1 low ambient test point at 5°F are achieved by the native controls

⁵ 10 CFR part 430, Subpart B, Appendix M1 – Section 3.6 Heating mode tests for Different Types of Heat Pumps, Including Heating-Only Heat Pumps

operating as they would in a customer's home. Either the [ENERGY STAR Cold Climate Heat Pump CVP](#) or a CVP adopted into the Code of Federal Regulations by the DOE is acceptable.

- C. Installation Capabilities: This section presents installation capabilities criteria for ENERGY STAR certified Heat Pumps. Compliance with Section 3.C criteria is optional and those products that comply will be identified on the ENERGY STAR website.

HPs shall be capable of providing at least three of the following capabilities to aid in quality installation. Mini-splits and multi-splits shall have at least two of the capabilities. For purposes of this section, a thermostat or controller (for example, but not limited to devices such as smartphone or tablet with a manufacturer app to control the unit) can be considered part of the system. Items a., b., and c. are understood to be measured at an appropriate fan speed and capacity.

- a. Refrigerant charge – System can self-verify that the refrigerant charge is within manufacturer recommended tolerances at a range of conditions including outdoor temperatures at least as low as 65°F or can estimate and report refrigerant charge level. An alert that only initiates when the charge is critically low does not satisfy this requirement.
 - b. Airflow measurement or external static pressure – System shall have some capability to self- estimate and report airflow and/or confirm that it is within the OEM recommended settings, or to self-measure and display external static pressure and the fan speed setting. For split systems, this capability may be contingent on the recognized product being paired with a specific furnace or air handler. (Capability not applicable to ductless units.)
 - c. Blower fan power draw – System shall have the capability to self-measure and report the watt draw of the blower fan. For split systems, this capability may be contingent on the recognized product being paired with a specific furnace or air handler. (Capability not applicable to ductless units.)
 - d. Test mode for manual measurements – The system provides an easily accessible test mode that locks the system into an appropriate fan speed and compressor capacity setting for testing refrigerant change, airflow/external static pressure, and blower fan power draw available in that installation.
 - e. Automatic system discovery – System is capable of automatically recognizing compatible communicating indoor/outdoor units, furnaces. Automatic discovery of humidifiers and dehumidifiers is encouraged.
 - f. Preprogrammed system tests – System shall automatically prompt the installer to run preconfigured system tests following the initial setup. These tests should verify, at a minimum, fan blower, cooling-mode, heat pump only heating, and auxiliary heating tests as applicable to the product and season of installation. The system shall store all faults recognized during these tests until the installer corrects the related issues.
- D. Multiple Assemblies: For split system HPs, ENERGY STAR certification shall be determined by the rated performance of the particular combination of indoor and outdoor units as tested in accordance with the appropriate regional test procedure, regardless of the fact that the components may be used in other combinations.
- E. Gas/Electric Package Units: To certify as ENERGY STAR, gas/electric package units shall meet the single package specification requirements in Table 2 for HPs, above. Gas/electric packaged HPs may not achieve the Cold Climate HP label.
- F. ICM coil combinations: To certify as ENERGY STAR, ICM coil combinations shall meet the Heat Pump Split System specification requirements in Tables 2 and 3 above and include a condensing (outdoor) unit listed in the ENERGY STAR program by a system manufacturer.

- G. The HSPF2 and SEER2 ratings for split systems shall be identical to the levels reported to the DOE and appropriately reflected on the current Federal Trade Commission (FTC) Energy guide label. For packaged units, the HSPF2 and SEER2 ratings shall be identical to the levels reported on the FTC Energy guide label and to those reported to DOE. For all units where EER2 (or EER) is reported to the DOE, the EER2 reported to

the EPA shall be identical.

H. Additional Reporting Requirements:

- a. Report the type of refrigerant used in the HP, e.g. HFC-32 or R-454B.
- b. For all models, report whether a CVP was performed and identify which one, e.g. ENERGY STAR Cold Climate or the DOE.
- c. For HPs, report the heating capacity and COP at 5F, per the H4₂ test point in Appendix M1.

I. Significant Digits and Rounding:

- a. All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Unless otherwise directed below, calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.
- b. Unless otherwise specified, compliance with specification limit shall be evaluated using exact values without any benefit from rounding.
- c. As specified in 10 CFR, 430.23(m)(3), SEER2, and HSPF2 shall be rounded off to the nearest 0.025 Btu/W.h. Similarly, EER2 should also be rounded off to the nearest 0.025 Btu/W.h.
- d. As specified in 10 CFR, 430.23(m)(3), capacity shall be expressed in accordance with Table 4, below:

Table 4: Rounding Requirements for Capacity

Capacity Ratings, Btu/h	Multiples, Btu/h
< 20,000	50
≥ 20,000 and < 38,000	100
≥ 38,000 and < 65,000	250

4) Connected Product Criteria:

This section presents connected criteria for ENERGY STAR certified HPs. Compliance with Section 4 criteria is optional. ENERGY STAR certified products that comply with all Section 4 criteria will be identified on the ENERGY STAR website as having 'Connected' functionality.

A. Definitions

- a. Connected HP System (CCS): Includes the ENERGY STAR certified HP product, integrated or separate communications hardware, and additional hardware and software required to enable connected functionality, including controllers/thermostats. In the case of a CCS that implements Open ADR 2.0 with a virtual end node (VEN) in the cloud, that VEN is part of the CCS for purposes of this specification. For products implementing CTA-2045A, the module is not considered part of the CCS for purposes of this specification. A product implementing both using a communication module in a CTA-2045 port could be

tested both ways and identified as implementing both standards for the purposes of the ENERGY STAR product finder.

- b. Consumer Authorized Third Party: Any entity for which the consumer has provided explicit permission to access the CCS connected functionality, in whole or in part, via a communication link.
- c. Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers between the connected HP system and one or more external applications, devices or systems.

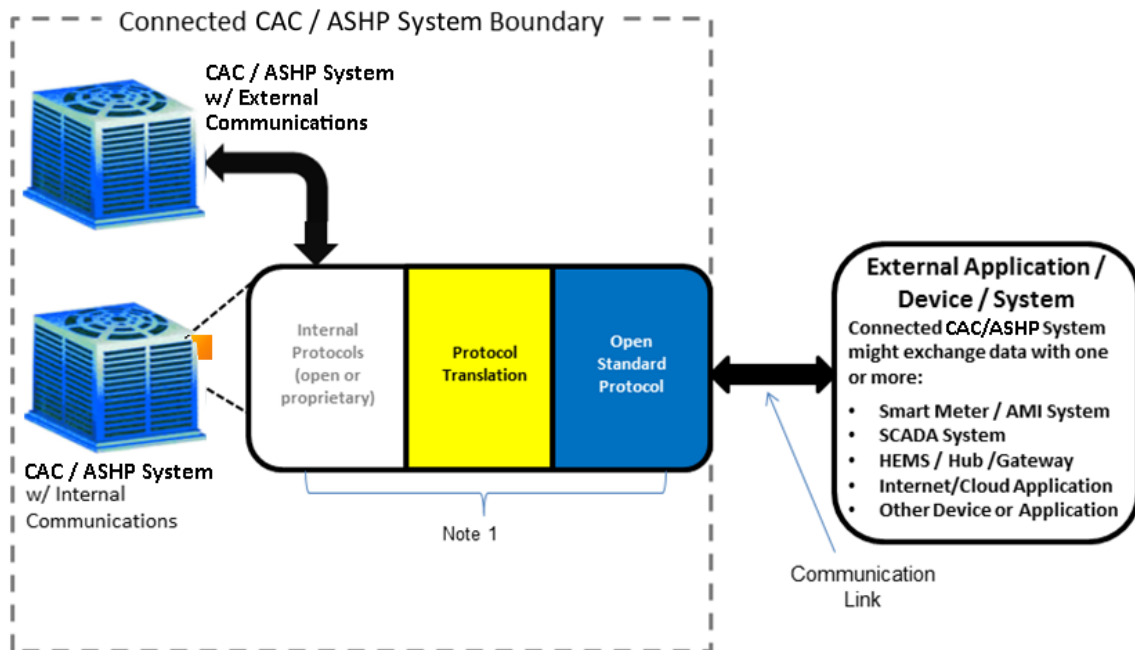


Figure 1. Connected HP System (CCS)

Note 1: Communication device(s), link(s) and/or processing that enables Open Standards-based communication between the CCS and external application / device / system(s). These elements, either individually or together, could be within the product/controller, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

- d. Demand Response (DR)⁶: Changes in electric usage by demand-side resources from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.
- e. Demand Response Management System (DRMS): The system operated by a program administrator, such as the utility or third party, which dispatches signals with DR requests and/or price signals to the CCS products and receives messages from the CCS product.
- f. Interface Specification: A document or collection of documents that contains detailed technical information to facilitate access to relevant data and product capabilities over a communications interface.

⁶ Federal Energy Regulatory Commission, <https://www.ferc.gov/electric/industry-activity/demand-response/national-assessment-and-action-plan-demand-response>. This definition does not cover all aspects of how load flexibility is being used by utilities. For instance, it does not cover behavioral DR, dispatch to prevent spilling wind resources, or reducing peak demand for natural gas. The EPA intends to address any and all of these use cases in our criteria in addition to the more traditional DR in the FERC definition.

- g. Load Management Entity: DRMS, home energy management system, and the like.
- h. Open Standards: Communication with entities outside the CCS that use, for all communication layers, standards:
 - included in the Smart Electric Power Alliance (SEPA) Catalog of Standards⁷, and/or
 - included in the NIST Smart Grid Framework Tables 4.1 and 4.2⁸, and/or
 - adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or Internet Engineering Task Force (IETF).^{6F8F}⁹
- i. On-Premises: Refers to a function that relies only on equipment present at the physical installed location of the ENERGY STAR certified device/equipment.
- j. Consumer Override (of DR events): Choosing to opt out of a scheduled and/or active DR event the product would otherwise respond to, without cancelling program enrollment.

B. Communications

- a. The CCS Communication Link, in Figure 1, shall use Open Standards for all communication layers to enable functions listed in Section 4D).
- b. An Interface Control Document (ICD), Application Programming Interface (API), or other documentation shall be made available to interested parties that, at minimum, allows access to the functions listed in Section 4D) and is recommended for Section 4C).

C. Consumer Feedback

a. **User Alerts**

The CCS shall be capable of providing at least two types of messages relevant to optimizing its energy consumption, communicating to residents either:

- i. On the product (if intended to be installed in conditioned space) or its consumer control interface, and/or
- ii. Transmitted to consumers and consumer authorized third parties via a communication link. This link can include open standards protocols used for DR or could use a secondary communication link.

For example, messages relevant to energy consumption for HPs might address a fault condition, a reminder to replace a filter, heat pump refrigerant charge, or a report of energy consumption that is outside the product's normal range.

Note: Products meeting ENERGY STAR Most Efficient criteria for system status and messaging are compliant with this requirement.

⁷ <https://sepapower.org/knowledge/catalog-of-standards/>

⁸ <https://www.nist.gov/system/files/documents/smartgrid/NIST-SP-1108r3.pdf>

⁹ <http://www.gridstandardsmap.com/>

b. **Energy Reporting**

The product shall be capable of transmitting measured or estimated instantaneous power draw in current conditions via a communication link to energy management systems and other consumer authorized devices, services, or applications. Provision of this information through the communication link and protocol used for demand response shall meet this requirement. *Example: A CCS uses CTA-2045A to comply with section 4D) and implements CommodityRead functionality.*

D. Demand Response (DR)

a. **DR Communications Protocols**

The CCS shall meet the communication and equipment performance standards for CTA-2045-A or OpenADR 2.0b, or both.

b. **Consumer Override**

The CCS shall provide an easily accessible means for consumers to override demand response events during the event or ahead of time for a scheduled event. When the event is overridden, the CCS shall return to its previous operating mode.

Temporary overrides shall be limited to a duration up to 72 hours without additional user input; after this time, the CCS will return to its previous operating mode.

Note: Long term (persistent) overrides are not restricted, as some users may opt to use this functionality. The EPA recommends encouraging the use of temporary overrides to consumers when appropriate.

c. **DR Information and Messaging**

The CCS shall support the following upstream messaging from the device as supported by application layer protocol(s) and may support the additional (optional) messaging capabilities. Support for these messaging signals is implemented via the open standards protocol used in the product. Implementation details are described in Appendix A.

Required DR Messaging I/O:

Messaging I/O Operation	Messaging Operation Description
Verifying Connectivity	Ensures target CCS is connected to DRMS and prepared to accept DR signals.
System Capabilities	Requests basic CCS level information on target device, including equipment type response capability.
Operational State(s)	Requests information on CCS running state, DR conditions operating on product, opt in/out state, and current fault conditions. Note: Operational State data structure and layout may vary by application layer protocol, containing the following device state information:

Operational State Codes:

Operational State Code	Operational State Definition
Idle Normal	Indicates that no DR event is in effect and the CCS has no/insignificant energy consumption.
Running Normal	Indicates that no DR event is in effect and the CCS is running normal under local control.
Running Curtailed	Indicates that a curtailment type DR event is in effect and CCS is running in General Curtailment mode
Running Heightened	Indicates that a heightened-operation type of DR event is in effect and CCS is running in Critical Curtailment mode.
Idle Curtailed	Indicates that a curtailment type DR event is in effect and the CCS is in off mode.
CCS Error Condition	Indicates that the CCS is not operating or is in some way disabled (for example, no response to the grid).
Idle Heightened	Indicates that a heightened-operation type of DR event is in effect and the CCS is in off mode.
Idle Opted Out	Indicates that the HVAC system is presently opted out of any DR events and the system is in off mode.
Running, Opted Out	Indicates that the SGD is presently opted out of any DR events and the SGD is operating normal under local control.

d. DR Requests and Responses

The CCS shall also support the required DR operational modes listed below and may support additional open standard defined DR signals.

i. Required Operational Mode Functionality:

Operational Mode Function	Operational Mode Description
Maximum Indoor Temp. Rise	Specifies the maximum indoor temperature rise that the equipment must use when processing curtailment and/or price responsive modes.
General Curtailment	Directs equipment to reduce power consumption to a maximum of 70% of rated load power. Applicable to both staged and variable capacity equipment.
Critical Curtailment	Directs equipment to reduce power consumption to a maximum of 40% of rated load power. Staged equipment is not anticipated to respond to this message type; DRMS may substitute a General Curtailment message for this equipment type. Both staged and variable capacity equipment in heating mode shall not use resistance heating while indoor ambient temperature is equal to or above 62° F.

Off Mode	Directs equipment to turn to off mode, while maintaining compressor crankcase heater power and system controls power. Applicable to both staged and variable capacity equipment.
End Active Events	Notifies equipment that current or upcoming DR event(s) are cancelled.
Advanced Notification	Notifies equipment of an upcoming DR event. Equipment may perform preheating / precooling as appropriate. Note: Protocol dependent, may be attached to DR signals in some application layers.
Utility Peak Load Price Signal	Notifies equipment that a peak price period is in effect and contains relative pricing info on this event. Equipment manufacturer may provide user with the means to configure system to automatically respond to peak load price signals.
Customer Override	Notifies DRMS that a consumer has overridden a current / scheduled DR event.

ii. Operational Requirements:

Variable capacity equipment must ramp up/down changes in power over a minimum of 5 seconds, to decrease transients generated by operation.

E. Additional Information for Consumers

- a. If additional modules, devices, services, particular controllers/thermostats, and/or supporting infrastructure are required in order to activate the CCS's communications capabilities, installation instructions and a list of these requirements shall be prominently displayed in the product literature and cut sheets. These instructions shall provide specific information on what must be done to activate these capabilities (e.g. the brochure might include, "This product can participate in utility demand response programs if paired with model XD1124 thermostat, which has Wi-Fi capability and would also require Internet connectivity and a wireless router for this functionality.")

5) Test Requirements:

- A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR certification:
 - a. A single unit is selected, obtained, and tested. The measured performance of this unit and of each subsequent unit manufactured must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to certify additional individual model variations within a Basic Model as long as the definition for Basic Model provided in Section 1, above, is met; or
 - b. Ratings are determined pursuant to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.16 either by selecting units for testing or by the application of an alternative rating method (ARM) as defined in 10 CFR Part 429.70. The certified rating must be equal to or better than the ENERGY STAR specification requirements. Results of the tested or simulated unit may be used to certify additional model variations within a Basic Model as long as the definition provided above and in 10 CFR Part 430.2 is met. Further, all individual models within a Basic Model must have the same certified rating per DOE's regulations in Part 429 and this rating must be used for all manufacturer literature, the certified product list, and certification of compliance to DOE energy conservation standards.
- B. When testing HPs, the following test method shall be used to determine ENERGY STAR certification:

Table 5: Test Method for ENERGY STAR Certification

ENERGY STAR Requirement		Test Method Reference
SEER2, EER2, HSPF2		10 CFR part 430 Subpart B Appendix M1, including the optional H4 very low temperature condition
COP @ 5°F, Percentage of Heating Capacity @ 5°F		10 CFR part 430 Subpart B Appendix M1, including the optional H4 very low temperature condition
Controls Verification Procedure		ENERGY STAR Cold Climate HP CVP or a CVP adopted into the CFR by DOE
Installation Capabilities		Determined by examination of the product, its control system, and its documentation
Connected Products: Demand Response (Optional)		Evaluation of DR in HPs (in development) or certification to AHRI 1380* and examination of product documentation and interfaces

* Until a test method is established, products may certify as Connected through examination of the product, its control system, and its documentation. Recognition as meeting ENERGY STAR connected criteria is optional.

6) Effective Date: This ENERGY STAR Heat Pump Specification shall take effect on January 1, 2023. To certify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

7) Future Specification Revisions: The EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR certification is not automatically granted for the life of a product model.

In 2019 and 2020, the EPA's ENERGY STAR Emerging Technologies program recognized highly efficient air to water heat pumps that have acceptable cold climate performance. As this technology gains a foothold in the U.S., the EPA anticipates it will eventually make sense to include this type of product in the scope of this specification.

Appendix A: Demand Response Messaging:

Table 6: Normative DR Message Mapping

Category	Sub-type	Demand Response Messaging	Response Result	CTA (2045-A)	OpenADR (2.0b)
Basic Signals	Curtailment	General Curtailment	Reduce load (moderate)	Shed9F9F ¹⁰	oadrDistributeEvent: SIMPLE level 1.10F10F ¹¹
		Emergency Curtailment	Reduce load (major)	Critical Peak Event ¹⁰	oadrDistributeEvent: SIMPLE level 2. ¹¹
		Off Mode	Turn off (if possible)	Grid Emergency ¹⁰	oadrDistributeEvent: SIMPLE level 3. ¹¹
	Operational State	Return to Normal Operation	Return to defaults	End Shed / Run Normal ¹⁰	oadrDistributeEvent: CANCELLED.11F11F ¹²
		Advance Notice	No requirement (flexible)	Pending Event Time / Type ¹⁰	oadrDistributeEvent: NEAR / FAR / ACTIVE ¹²
Advanced Signals	Device State (in event)	Maximum Indoor Temp. Offset	Adjust setpoint for use in curtailment / price response	Get / Set Temperature Offset12F12F ¹³	oadrDistributeEvent: LOAD_CONTROL, x-loadControlSetpoint ¹¹
	Device Logic	Utility Peak Load Price Signal	Use / do not use energy when appropriate	Present Relative Price ¹⁰	oadrDistributeEvent: ELECTRICITY_PRICE ¹¹
Device Properties & Enrollment	Opt Out	Consumer Override	Skip response to event within opt out time window	Customer Override. Sent each time device is queried while opt out is active ¹⁰	oadrCreateOpt, oadrCancelOpt13F13F ¹⁴
	Dev. Info	Device Information	Indicates product type	Info Request ¹³	ei:eiTargetType (endDeviceAsset)14F14F ¹⁵
	Status	State Reporting Requirements	Provide state information to requestor	Query / State Query Response ¹³	EiReport. oadrPayloadResource-Status (see Table 7 and 8) ¹²

¹⁰ CTA-2045-A: Table 8-2

¹¹ OpenADR 2.0b, Section 8.2.2

¹² OpenADR 2.0b, Section 11.2

¹³ CTA-2045-A: Table 9-2

¹⁴ OpenADR 2.0b, Section 8.5

¹⁵ OpenADR 2.0b, Annex A

	Hardware	Hardware Requirements	Design of product & comms.	AC or DC Form Factor physical interface	-
Device Energy	Energy	Power (Instantaneous)	Demand of product (W)	Get CommodityRead, code 015F15F ¹⁶	oadrReport: energyReal ¹²
		Energy (Cumulative)	Energy used by product (kWh)	Get CommodityRead, code 0 ¹⁶	oadrReport: energyReal ¹²

Table 7: Operational State Codes

Op State Code	Name
0	Idle Normal
1	Running Normal
2	Running Curtailed Grid
3	Running Heightened Grid
4	Idle Grid
5	Water Heater Error
6	Idle Heightened
11	Idle, Opted Out
12	Running, Opted Out

Table 8: OpenADR 2.0b Operational State Reporting¹⁷

<i>OpenADR 2.0b EiReport Service</i>			
REQ	Report Name	x-CTA2045_Status	
M1.1	Report Structure	Status	Interval
	rID	OperationalState	1-min
	Report Type	Reading	
	Reading Type	Direct Read	
Units	customUnit		
<i>ANSI/CTA-2045-A Message</i>			
Message		Operational State Query Response	
Element Mapped to rID		Opcode 2 of Basic 0x13	

¹⁶ CTA-2045-A, Section 9.3.1

¹⁷ Electric Power Research Institute, Communication Protocol Mapping Guide 1.0, OpenADR 2.0 to ANSI/CTA-2045-A, Table 2-3 Measurement and Reporting Mapping Requirements