



ENERGY STAR® Program Requirements for Geothermal Heat Pumps

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 geothermal heat pumps. 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 EPA for geothermal heat pumps. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform geothermal heat pump 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 geothermal heat pumps.
 - 5.1. The ENERGY STAR mark must be clearly displayed on the 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.
 - 5.2. It is also recommended that the mark appear on the top/front of the product and on the product packaging.

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for geothermal heat pumps, providing full cooperation and timely responses. 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 EPA

7. Provide unit shipment data or other market indicators to 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 geothermal heat pumps shipped in the calendar year or an equivalent measurement as agreed to in advance by 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 EPA.
- 7.3. Partner must submit unit shipment data for each calendar year to 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 EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner.

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. Notify 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: proper equipment installation and hookup; distribution systems and their effect on performance; proper domestic water heater connection for desuperheater or demand water heating; code compliance; and proper use of the Manual J calculation¹, or other equivalent calculation, in order to encourage proper sizing of equipment.
 - 10.2. Partner should strive to use contractors or loop installers who have received training on the design and installation of the ground heat exchanger and who provide warranty protection for the integrity and performance of the ground heat exchanger for at least two years.
 - 10.2.1. Ground heat exchanger training may be provided by Partner or a well-regarded training program.
 - 10.2.2. Partner shall focus its ENERGY STAR marketing efforts in regions where contractors and loop installers have received training and provide warranties.
 - 10.3. Offer a means to provide some or all of the domestic water heating through the use of a desuperheater, integrated demand water heater, or stand-alone demand water heating model. Partner will strive to ensure that customers, distributors, and contractors are made aware of the benefits of using a geothermal heat pump system to provide water heating in its marketing materials, installation manuals, and training programs.

Performance for Special Distinction

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

¹ Manual J Calculation: A calculation performed to determine the heating load for a residence or small commercial building. The calculation shall include site-specific characteristics such as regional weather data, building framing materials, building insulation levels, building air infiltration levels, and window area. The calculation follows procedures and protocols developed by the Air Conditioning Contractors of America (ACCA).

- Provide quarterly, written updates to 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 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), 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 EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, 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 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 EPA on one print advertorial and one live press event.
- Join 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 EPA's Green Power Partnership. 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 Geothermal Heat Pumps

Eligibility Criteria Version 3.1

Following is the **Version 3.1** product specification for ENERGY STAR qualified geothermal heat pumps. 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. Geothermal Heat Pump: A geothermal heat pump uses the thermal energy of the ground or groundwater to provide residential space conditioning and/or domestic water heating. A geothermal heat pump model normally consists of one or more factory-made assemblies that include indoor conditioning and/or domestic water heat exchanger(s), compressors, and a ground-side heat exchanger. A geothermal heat pump model may provide space heating, space cooling, domestic water heating, or a combination of these functions and may also include the functions of liquid circulation, thermal storage, air circulation, air cleaning, dehumidifying or humidifying. A geothermal heat pump system generally consists of one or more geothermal heat pump models, the ground heat exchanger(s), the air and/or hydronic space conditioning distribution system(s), temperature controls, and thermal storage tanks.
- B. Single-Stage: Geothermal heat pumps that are designed to operate at one stage and one capacity.
- C. Multi-Stage: Geothermal heat pumps that are designed to operate at more than one stage or capacity through the use of technologies such as multiple stage compressors, dual compressors, variable speed compressors, etc. Multi-stage models are more efficient while running at lower capacities, but have the capability to supply more heating or cooling using higher capacities when required.
- D. Ground Heat Exchanger: The method by which heat is exchanged with the ground, groundwater, or surface water. Geothermal heat pumps may use any form of ground heat exchange, which includes horizontal, vertical, or submerged surface water closed loops; open loops using ground water, reclaimed water, or surface water; or direct refrigerant-to-ground or refrigerant-to-water heat exchange.
- E. Closed Loop: A ground heat exchange method in which the heat transfer fluid is permanently contained in a closed piping system. Also called a *ground-loop* system.
- F. Open Loop: A ground heat exchange method in which the heat transfer fluid is part of a larger environment. The most common open loop systems use ground water, reclaimed water, or surface water as the heat transfer medium. Also called a *ground-water* system.
- G. Water-to-Air: A geothermal heat pump model that provides space conditioning primarily by the use of an indoor air heat exchange coil. Water-to-air models may also provide domestic water heating and hydronic space heating by using desuperheater and/or demand water heating functions.
- H. Water-to-Water: A geothermal heat pump model that provides space conditioning and/or domestic water heating by the use of indoor refrigerant-to-water heat exchanger(s). Water-to-

water models may provide domestic water heating by using desuperheater and/or demand water heating functions.

- I. Direct Geoexchange (DGX): A geothermal heat pump model in which the refrigerant is circulated in pipes buried in the ground or submerged in water that exchanges heat with the ground, rather than using a secondary heat transfer fluid, such as water or antifreeze solution in a separate closed loop.
- J. Desuperheater: A partial heat recovery system that captures heat from the hot refrigerant gas as it leaves the heat pump compressor and transfers it to the domestic hot water. Desuperheaters provide hot water only while the heat pump is providing space conditioning.
- K. Demand Water Heating: Demand geothermal heat pump water heating models provides for all, or nearly all, of the domestic hot water needs even when space conditioning is not required. This may be accomplished by either stand-alone domestic water heating models or integrated models that use the same compressor for both space conditioning and domestic water heating. This product type is sometimes referred to as a *dedicated* or *full-time* water heater.
- L. Coefficient of Performance (COP): A measure of efficiency in the heating mode that represents the ratio of total heating capacity to electrical energy input.
- M. Energy Efficiency Ratio (EER): A measure of efficiency in the cooling mode that represents the ratio of total cooling capacity to electrical energy input.
- N. Product Family: A group of models, where the same remote unit is used with several blower coil combinations (horizontal, vertical, A-coil, etc.). The “same remote unit” is defined as the unit with the same or similar compressor and same direct geoexchange heat exchanger, such that the energy efficiency and performance of all models can be accurately predicted from test data of a single model.

2) Scope:

- A. Included Products: Open loop, closed loop, and DGX products that meet the definition of a Geothermal Heat Pump as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B.
- B. Excluded Products: Geothermal heat pumps intended for commercial use (i.e., 3-phase units) are not eligible for ENERGY STAR.

3) Qualification Criteria:

A. Energy Efficiency Requirements:

Table 1: Tier 1 Requirements		
Product Type	EER	COP
Water-to-Air		
Closed Loop Water-to-Air	14.1	3.3
Open Loop Water-to-Air	16.2	3.6
Water-to-Water		
Closed Loop Water-to-Water	15.1	3.0
Open Loop Water-to-Water	19.1	3.4
DGX		
DGX	15.0	3.5

Table 2: Tier 2 Requirements		
Product Type	EER	COP
Water-to-Air		
Closed Loop Water-to-Air	16.1	3.5
Open Loop Water-to-Air	18.2	3.8
Water-to-Water		
Closed Loop Water-to-Water	15.1	3.0
Open Loop Water-to-Water	19.1	3.4
DGX		
DGX	16.0	3.6

Table 3: Tier 3 Requirements		
Product Type	EER	COP
Water-to-Air		
Closed Loop Water-to-Air	17.1	3.6
Open Loop Water-to-Air	21.1	4.1
Water-to-Water		
Closed Loop Water-to-Water	16.1	3.1
Open Loop Water-to-Water	20.1	3.5
DGX		
DGX	16.0	3.6

B. Qualifying Multi-Stage Models: Multi-stage models shall be qualified using the following calculations:

- $EER = (\text{highest rated capacity EER} + \text{lowest rated capacity EER}) / 2$
- $COP = (\text{highest rated capacity COP} + \text{lowest rated capacity COP}) / 2$

C. 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. 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.

4) Warranty Requirements: Partner shall provide, as standard, a manufacturer limited warranty for its ENERGY STAR qualified geothermal heat pump models for all parts and labor for a minimum of two

years. The major refrigerant circuit components, including the compressor(s), heat exchanger(s), and expansion and reversing valve(s) shall be warranted for parts and labor for a minimum of five years.

5) Test Requirements:

- A. Representative Models shall be selected for testing per the following requirements:
 - a. For qualification of an individual product model, the representative model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
 - b. For qualification of a product family, any model within that product family can be tested and serve as the representative model.
- B. When testing geothermal heat pumps, the following test methods shall be used to determine ENERGY STAR qualification:

Table 4: Test Methods for ENERGY STAR Qualification		
ENERGY STAR Requirement	System Type	Test Method Reference
EER and COP	Closed and Open Loop Systems	ISO 13256-1-1998 “ <i>Water-source heat pumps -- Testing and rating for performance -- Part 1: Water-to-air and brine-to-air heat pumps</i> ” for water-to-air models OR ISO 13256-2-1998 “ <i>Water-source heat pumps -- Testing and rating for performance -- Part 2: Water-to-water and brine-to-water heat pumps</i> ” for water-to-water models
	DGX Systems	ANSI/AHRI 870-2005 “ <i>Performance Rating of Direct Geexchange Heat Pumps</i> ”

- 6) **Effective Date:** This ENERGY STAR Geothermal Heat Pump Specification shall take effect on the dates specified in Table 5, below. To qualify 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.

Table 5: Specification Effective Dates		
Tier 1	Tier 2	Tier 3
December 1, 2009	January 1, 2011	January 1, 2012

- 7) **Future Specification Revisions:** 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 qualification is not automatically granted for the life of a product model.