



ENERGY STAR® Program Requirements for Residential Climate Controls

Version 1.0 Partner Commitments DRAFT 1

Note: In developing this Climate Control specification, EPA's goal is to guide consumers to products that are superior in their usability and are effective tools for making homes comfortable and monitoring and controlling home energy use. The Draft 1 Version 1.0 ENERGY STAR Residential Climate Controls specification builds upon the previous Draft 1 Version 2.0 Programmable Thermostat specification including incorporation of revisions based upon stakeholder comments. A number of key requirements proposed in the Draft 1 Version 2.0 document continue to be relevant to ENERGY STAR qualified Climate Controls. As such, this Draft 1 Version 1.0 Residential Climate Controls specification continues to propose several of these requirements.

Commitment

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacturing of ENERGY STAR qualified Climate Controls. The ENERGY STAR Partner must adhere to the following program requirements:

- comply with current ENERGY STAR Eligibility Criteria, defining the performance criteria that must be met for use of the ENERGY STAR certification mark on Climate Controls and specifying the testing criteria for Climate Controls. EPA may, 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 EPA's request;
- comply with current ENERGY STAR Identity Guidelines, describing how the ENERGY STAR marks, name, and educational graphic may be used. Partner is responsible for adhering to these guidelines and for ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance;
- participate in consumer education activities which may include, but is not limited to, any of the following tactics:
 - Providing educational content (e.g., consumer brochure, takeaways, etc.) for use in retail stores
 - Using the ENERGY STAR education graphic in product literature (i.e., user manuals, spec sheets, marketing materials, etc.) and on the manufacturer's Internet site
 - Consistently using approved messaging on product packaging/literature, Web site, trade articles, training for retail employees, and other channels
 - Providing educational content to distributors/dealers for use with their customers
 - Providing brochures, signage, etc. to distributors/dealers for their store, as appropriate
 - Providing messaging to the distributors/dealers to use in their advertising and promotions
- qualify at least one ENERGY STAR Climate Control model *within one year of activating the Climate Controls portion of the agreement*. When Partner qualifies the product, it must meet the specification (e.g., Tier 1 or 2) in effect at that time;

Note: The partner commitments section will be expanded in the Final specification to include the new ENERGY STAR testing requirements and other program changes proposed in the Enhanced Program Plan for ENERGY STAR products. The above language is expected to change as a result of this enhancement effort. EPA will work with interested stakeholders to develop these new requirements. As such, EPA will host a series of stakeholder meetings focused on testing requirements. Please visit the Web site at www.energystar.gov/mou for information on the proposed requirements and planned meetings.

- provide clear and consistent labeling of ENERGY STAR qualified Climate Controls. The ENERGY STAR mark must be clearly displayed on the front of the product, in product literature (i.e., user manuals, spec sheets, etc.), on product packaging, and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed;
- provide to EPA, on an annual basis, an updated list of ENERGY STAR qualifying Climate Control models. Once the Partner submits its first list of ENERGY STAR qualified Climate Control models, the Partner will be listed as an ENERGY STAR Partner. Partner must provide annual updates in order to remain on the list of participating product manufacturers;
- provide to EPA, on an annual basis, unit shipment data or other market indicators to assist in determining the market penetration of ENERGY STAR. Specifically, Partner must submit the total number of ENERGY STAR qualified Climate Controls shipped (in units by model) or an equivalent measurement as agreed to in advance by EPA and Partner. Partner is also encouraged to provide ENERGY STAR qualified unit shipment data segmented by meaningful product characteristics (e.g., capacity, size, speed, or other as relevant), total unit shipments for each model in its product line, and percent of total unit shipments that qualify as ENERGY STAR. The data for each calendar year should be submitted to EPA, preferably in electronic format, no later than the following March and may be provided directly from the Partner or through a third party. The data will be used by EPA only for program evaluation purposes and will be closely controlled. Any information used will be masked by EPA so as to protect the confidentiality of the Partner; and
- notify EPA of a change in the designated responsible party or contacts for Climate Controls within 30 days.

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:

- consider energy efficiency improvements in company facilities and pursue the ENERGY STAR mark for buildings;
- 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;
- ensure the power management feature is enabled on all ENERGY STAR qualified monitors 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 product models;

- 99 • feature the ENERGY STAR mark(s) on Partner Web site and in other promotional materials. If
100 information concerning ENERGY STAR is provided on the Partner Web site as specified by the
101 ENERGY STAR Web Linking Policy (this document can be found in the Partner Resources section
102 on the ENERGY STAR Web site at www.energystar.gov), EPA may provide links where appropriate
103 to the Partner Web site;
104
- 105 • provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the
106 program requirements listed above. By doing so, EPA may be able to coordinate, communicate,
107 and/or promote Partner's activities, provide an EPA representative, or include news about the event
108 in the ENERGY STAR newsletter, on the ENERGY STAR Web pages, etc. The plan may be as
109 simple as providing a list of planned activities or planned milestones that Partner would like EPA to
110 be aware of. For example, activities may include: (1) increase the availability of ENERGY STAR
111 qualified products by converting the entire product line within two years to meet ENERGY STAR
112 guidelines; (2) demonstrate the economic and environmental benefits of energy efficiency through
113 special in-store displays twice a year; (3) provide information to users (via the Web site and user's
114 manual) about energy-saving features and operating characteristics of ENERGY STAR qualified
115 products, and (4) build awareness of the ENERGY STAR Partnership and brand identity by
116 collaborating with EPA on one print advertorial and one live press event;
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- 118 • provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase
119 availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and
120 its message;
121
- 122 • join EPA's SmartWay Transport Partnership to improve the environmental performance of the
123 company's shipping operations. SmartWay Transport works with freight carriers, shippers, and other
124 stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and
125 air pollution. For more information on SmartWay, visit www.epa.gov/smartway;
126
- 127 • join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions.
128 Through participation, companies create a credible record of their accomplishments and receive
129 EPA recognition as corporate environmental leaders. For more information on Climate Leaders, visit
130 www.epa.gov/climateleaders; and
131
- 132 • join EPA's Green Power partnership. EPA's Green Power Partnership encourages organizations to
133 buy green power as a way to reduce the environmental impacts associated with traditional fossil
134 fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune
135 500 companies, small and medium businesses, government institutions as well as a growing
136 number of colleges and universities, visit www.epa.gov/grnpower.



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ENERGY STAR® Program Requirements for Residential Climate Controls

Version 1.0 Eligibility Criteria Draft 1

Below is the **Draft 1** Version 1.0 product specification for ENERGY STAR qualified Residential Climate Controls. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

Note: The Climate Control product category, while distinct, evolved from the previous Programmable Thermostat category, and some devices which previously qualified under the Programmable Thermostat specification may also qualify under this Version 1.0 Residential Climate Controls specification. EPA received numerous comments on the Draft 1 Version 2.0 Programmable Thermostat specification released October 29, 2009. As a number of the requirements reflected in that draft, are also proposed here, EPA notes responses to many of those comments in this ENERGY STAR Residential Climate Controls Draft 1 Version 1.0 specification.

Comments that resulted in changes made to this initial proposal are identified in note boxes found throughout the document. These note boxes also include EPA's justification for adding or changing the proposed requirement.

Stakeholders are encouraged to review the Draft 1 Version 2.0 Programmable Thermostat Comment Response document, which also addresses key areas where EPA received significant input but did not make changes to proposed requirements. This document can be found on the ENERGY STAR Web site at www.energystar.gov/newspecs (click on "Climate Controls").

To aid in the review of this Draft 1 Version 1.0 specification, EPA has noted new requirements in **red font**. The remaining text was pulled directly from the Draft 1 Version 2.0 Programmable Thermostat specification.

Stakeholders are encouraged to provide feedback on this latest proposal **by April 30, 2010**. EPA will host a stakeholder conference call to discuss this Draft 1 document on April 19, 2010. More details on this meeting will be distributed to stakeholders within one week of the Draft 1 release.

1) Definitions

Note: This Section has been restructured to group similar terms together based on the following common themes: climate control product types and features; energy management systems; HVAC equipment; and Time of Use.

A. Climate Controls

1. **Climate Control:** A device that controls heating, ventilation, and air-conditioning (HVAC) equipment to regulate the temperature and humidity of the room or space in which it is installed. A Climate Control enables the customer to schedule comfort and energy-saving periods; for when the occupant is home and away or asleep, respectively. An energy-saving setpoint is automatically initiated during energy-saving periods and a comfort setpoint during occupied periods. A Climate Control may be capable of controlling one or more zones of a conditioned space. The following Climate Controls are covered by this specification:

- 193 2. Communicating Climate Control: A Climate Control with the ability to communicate with
194 sources external to the HVAC system for purposes of energy management and remote
195 control. External sources include but are not limited to: (1) customer signals from home
196 computer or mobile device, (2) utility price signals and display messages, and, (3) home
197 energy management device signals. Examples of capabilities provided by such systems
198 include: Internet-enabled scheduling, remote Heating, Ventilating, and Air Conditioning
199 (HVAC) control; messaging and energy rate alert display. The communication link may be
200 wired or wireless. Where Open standards exist, they must be used.
201
- 202 3. Residential (Communicating) Climate Control: A Climate Control intended for installation in
203 homes and dwellings. This device includes fan modes and a default program schedule
204 suitable for typical residential usage.
205
- 206 4. Non-Residential (Communicating) Climate Control: A Climate Control intended for
207 commercial installation in the workplace. This device differs from the Residential Climate
208 Control in fan operation, HVAC control algorithms and includes default program schedule with
209 occupied/away periods suitable for typical commercial usage.

210 **Note:** New definitions are included for Climate Control and Communicating Climate Control to support the
211 Climate Control communication requirements proposed in Section 3, below.

- 212 5. Line Voltage (Communicating) Climate Control: A device that controls HVAC equipment to
213 regulate the temperature of the room or space in which it is installed by controlling the line-
214 voltage HVAC electrical load directly or indirectly through a line-voltage operating circuit.
215
- 216 6. Low Voltage (Communicating) Climate Control: A device that controls HVAC equipment to
217 regulate the temperature of the room or space in which it is installed by controlling the applied
218 energy in a National Electrical Code (NEC) Class 2 circuit.
219
- 220 7. Setpoint: The temperature setting in degrees Fahrenheit or degrees Celsius for any given time
221 period.
222
- 223 8. Comfort Time: The time period during which the conditioned space is expected to be occupied
224 (e.g., the early morning and evening hours for a residence).
225
- 226 9. Comfort Setpoint: The temperature setting in degrees Fahrenheit or degrees Celsius for the
227 time period during which the premises is expected to be occupied (e.g., the early morning and
228 evening hours for a residence).
229
- 230 10. Energy-Saving Setpoint: The temperature setting in degrees Fahrenheit or degrees Celsius
231 for the time periods during which the premises is expected to be unoccupied or during which
232 occupants are sleeping (e.g., the day and night hours for a residence).

233 **Note:** A more detailed definition for energy-saving setpoint has been included to add clarity. Also, EPA
234 has removed the cycle rate requirement presented in Section 3 of the previous Draft 1 Version 2.0
235 Programmable Thermostat specification so the cycle rate definition has been deleted in this section.

- 236 11. Set-Back Temperature: The setpoint for the energy-saving periods during the heating season,
237 generally at night and during unoccupied hours. This is a lower setpoint than the comfort
238 setpoint.
239
- 240 12. Set-Up Temperature: The setpoint for the energy-saving periods during the cooling season,
241 generally at night and during unoccupied hours. This is a higher setpoint than the comfort
242 setpoint.
243
- 244 13. Recovery, Conventional: A Climate Control algorithm that automatically initiates temperature
245 recovery at the programmed time entered into the programming schedule.

246
247 14. Recovery, Adaptive: A Climate Control algorithm that initiates recovery in advance of the
248 programmed time to result in the room temperature reaching the comfort setpoint at or near
249 the programmed time.

250
251 15. Recovery, Heat Pump with Auxiliary Heat: A Climate Control algorithm that that minimizes the
252 use of auxiliary heat to maximize energy savings.

253 **Note:** The recovery definitions proposed above are based on the current NEMA DC 3-2008 Standard.

254 16. Short Term Hold: This mode temporarily overrides the program setpoint. Short Term Hold
255 shall be active only until the next scheduled program event.

256
257 17. Long Term Hold: This mode suspends the Climate Control program schedule until the long
258 term hold mode is cancelled by the user.

259
260 18. Vacation Hold: This mode suspends the Climate Control program schedule until the user
261 specified date/time.

262
263 19. Scheduled Hold: This mode allows the user to schedule a future hold event that suspends the
264 Climate Control program. The user configurable Scheduled Hold parameters include start
265 date/time, end date/time and setpoint.

266
267 20. Timed Hold: This mode suspends the Climate Control program schedule for the user specified
268 time interval.

269 **Note:** In order to maximize energy reduction and usability, EPA has provided common definitions for a
270 wider range of hold modes. Used in conjunction with energy-saving setpoints, these modes will provide
271 additional means to decrease energy consumption during planned away periods. Required modes for
272 ENERGY STAR qualification are outlined in Section 3, below.

273 B. Heating Ventilation and Air Conditioning (HVAC) System Definitions

274
275 1. Heat Pump: A Heat Pump is a mechanical apparatus that normally consists of one or more
276 factory-made assemblies that include an indoor conditioning coil(s), compressor(s) and a
277 reversing mechanism to transfer heat to the premises from the outside air, ground or water in
278 heating mode and from the premises to the outside air, ground or water in cooling mode.

279
280 2. Non Heat Pump HVAC: For the purpose of this specification, non-heat pump HVAC
281 encompasses all other HVAC equipment including, but not limited to fossil fuel heat, central air
282 conditioning, electric resistance heating and evaporative coolers.

283
284 3. Dual Fuel Heat Pump: For the purpose of this specification, a Dual Fuel Heat Pump integrates
285 a heat pump with a fossil fuel furnace. To maximize efficiency of the system, the furnace is
286 utilized for cold outdoor temperatures and the heat pump for milder temperatures. The Climate
287 Control monitors outdoor temperature and selectively utilizes the two heat sources to optimize
288 energy efficiency.

289
290 4. Auxiliary Heat: Electric resistance heat used to supplement the heat pump during periods of low
291 temperature or rapid recovery.

Note: The term “Conventional HVAC” has been replaced with the term “Non Heat Pump HVAC” and additional clarification is provided to address specific product types in this category. Additional clarification has also been added to the Heat Pump definition, including harmonizing with the ENERGY STAR air-source heat pump specification, and Dual Fuel Heat Pump definition.

C. Energy Management System (EMS): An EMS is comprised of interconnected devices, integrated into a system designed to schedule, control, and monitor energy usage within a single dwelling. A typical system includes a controller that forms a network and acts as a gateway to the Internet, enabling secure web and mobile device remote access. The controller may incorporate embedded energy management software or leverage software located on a local PC or remote server. In addition to the controller, additional EMS devices may include in home displays (IHD), Communicating Climate Controls, direct load control relays, addressable light switches, meters and appliance modules. In general, each of these devices adds one or more of the following intrinsic functions:

- Load Control
- Measurement/logging
- Display/User Interface

The EMS provides enhanced usability including web and mobile device remote access, configuration and monitoring. It also aggregates energy usage data from interconnected devices and empowers the resident with tools and information intended to encourage responsible and reduced energy usage. The EMS may also help to identify low cost solutions that increase energy efficiency within the residence and in some cases may be configured to take **automatic action** to reduce consumption based on price signals, budget constraints and other triggering criteria.

Note: A new definition for Energy Management System (EMS) is provided to support Communicating Climate Control integration into these end-user systems.

D. Energy Services Interface (ESI): Provides security and, often, coordination functions that enable secure interactions between on premises relevant devices and the Utility. Permits applications such as remote load control, monitoring and control of distributed generation, in-home display of customer usage, reading of non-energy meters, and integration with building management systems. Also provides auditing/logging functions that record transactions to and from Home Area Networking Devices.

Note: The Energy Services Interface (ESI) definition is based on that published by the OpenHAN task force in the OpenHAN System Requirements Specification (SRS) v1.9, and is provided herein to support Communicating Climate Control integration into utility Automated Metering Infrastructure (AMI) and Demand Response (DR) systems defined below.

E. Advanced Metering Infrastructure (AMI): These systems are utility networks that measure, collect, and analyze metering data. AMI systems consist of hardware, software and communications. Typical implementations include advanced communicating energy meters, meter data management (MDM) systems and associated communications infrastructure. AMI systems may also include consumer energy displays and web portals for purposes of displaying energy usage data and facilitating remote control and energy use scheduling.

F. Demand Response (DR): These systems are utility control networks capable of directly impacting energy usage in residential and commercial buildings. These systems are utilized to reduce overall consumption in response to market conditions or periods of critical peak demand. Since residential energy consumption is dominated by HVAC energy consumption, DR implementations typically provide mechanisms for shedding HVAC load as a fundamental tool to reduce energy load. Secondary targets for DR control include electric hot water heaters and pool pumps.

G. Time of Use: Several power companies are offering Time of Use (TOU) pricing programs under which energy costs vary depending on the time of consumption and are assessed in accordance with a published schedule. The TOU schedule will have two or more schedule periods. Three tier TOU plans include tiers entitled Off-Peak, Mid-Peak and On-Peak, or similar, and are defined as the following:

1. Off-Peak: This pricing period has the least expensive energy rates and is normally scheduled for the night period.
2. Mid-Peak: Energy rates for this pricing period are positioned higher than Off-Peak, but lower than On-Peak prices. Mid-Peak rates are typically scheduled for the morning and evening periods during the Summer cooling season and during the afternoon and late evening for the Winter heating season.
3. On-Peak: This pricing period has the costliest energy rates and is normally scheduled for the afternoon period during the Summer cooling season and during the morning and early evening for the Winter heating season.

Note: New definitions have been added for Time of Use (TOU) and associated TOU plan tiers: Off-Peak, Mid-Peak, and On-Peak to support communication requirements proposed in Section 3, below. The above definitions are widely used by utilities with TOU programs.

H. Open Standard: For a standard to be considered open, it must meet the following:

- The standard is adopted and will be maintained by a not-for-profit organization, and its ongoing development occurs on the basis of an open decision-making procedure available to all interested parties.
- The standard has been published and the standard specification document is available either freely or at a nominal charge. It must be permissible to all to copy, distribute and use it for no fee or at a nominal fee.
- The intellectual property - i.e. patents possibly present - of (parts of) the standard is made irrevocably available on a royalty-free basis.
- There are no constraints on the re-use of the standard.

Note: The above Open Standard definition has been largely derived from the European Union definition. Stakeholder feedback is encouraged.

2) Qualifying Products

Any Residential Climate Control that complies with either the “Climate Control” or “Communicating Climate Control” definition in Section 1.A is eligible for ENERGY STAR qualification. For purposes of this Version 1.0 specification, Residential Climate Control refers to products intended for installation in homes and dwellings. A Residential Climate Control includes fan modes and a default program schedule suitable for typical residential usage. This specification covers devices that directly switch low voltage or line-voltage loads.

Note: Climate Controls intended for commercial installation in the workplace are not eligible for ENERGY STAR. These devices differ from the Residential Climate Control in fan operation and HVAC control algorithms, and include a default program schedule with occupied/away periods suitable for typical commercial usage.

Note: EPA is assessing the potential energy savings associated with Non-Residential Climate Controls and may consider expanding the specification to address these product types at a later date. Therefore, Non-Residential Climate Controls are explicitly defined in Section 1A and excluded in Section 2, above. Stakeholders are encouraged to provide information and data on non-residential products for EPA's consideration in subsequent versions of the specification, and comment on the text proposed above that intends to limit installation of residential thermostats in non-residential applications.

EPA recognizes the significant savings opportunity presented by line voltage heating, including baseboard and in-floor radiant systems. As such, EPA has extended eligibility to Line-Voltage Climate Controls, which were excluded in the Draft 1 Version 2.0 Programmable Thermostat specification.

ENERGY STAR qualified Residential Climate Controls must meet the following requirements:

- A. The product must provide a default, pre-programmed 5-2 (weekday – weekend) program schedule with a minimum of four possible schedule periods (i.e., morning, day, evening, and night). Default day and night periods must be at least 8 hours in duration.
- B. The product must provide one or more user selectable, pre-programmed 5-1-1 (weekday – Saturday – Sunday) and 7-day program schedules, each with a minimum of four possible schedule periods (i.e., morning, day, evening, and night). Default day and night periods must be at least 8 hours in duration.
- C. The product packaging and installation instructions must include the following statement:
“Residential Climate Control – This product is designed only for use in homes and other dwellings.”

Note: EPA has included the above statement in this Draft 1 Version 1.0 specification to discourage improper installation of Residential Climate Controls in non-residential applications. Such installations are likely to waste energy and not comply with applicable building codes.

- D. The product packaging and installation instructions must clearly indicate the types of HVAC systems it supports. For Low-voltage Climate Controls, this information shall include the number of controlled heating and cooling stages.

Note: EPA has included the above requirement in this Draft 1 Version 1.0 specification to simplify selection of an ENERGY STAR qualified Climate Control that will properly control the intended HVAC equipment.

- E. The product must either be (1) a Communicating Climate Control, as defined in Section 1.A above, or be (2) field upgradeable to a Communicating Climate Control by installation of a communication module.

Note: An EMS that includes a Communicating Climate Control will provide energy users with vastly improved and potentially real-time information on HVAC energy consumption and cost. Similarly, AMI and/or Demand Response systems that interconnect with Communicating Climate Controls will also be capable of providing dramatically enhanced HVAC consumption data. Armed with this information, users will be empowered and encouraged to adjust their HVAC usage to save energy and money. To enable EMS/ESI compatibility, ENERGY STAR qualified Residential Climate Controls must either ship with the ability to communicate with devices external to the HVAC system or be user upgradeable to add this capability. EPA envisions availability of modules to support various communications protocols to enable interoperability with a wide range of EMS and ESI devices. EPA is monitoring related standardization activities and encourages stakeholders to participate in organizations that are developing standards for universal communication modules. Where suitable open standards exist, Communicating Climate Controls must use them.

3) Energy Efficiency Criteria

Only those products referenced in Section 2, above, that meet the criteria below may qualify as ENERGY STAR.

Note: The Draft 1 Version 2.0 Programmable Thermostat specification outlined the high-level, required minimum characteristics of an ENERGY STAR qualified product. These characteristics have been incorporated, and prescribed in greater detail, in the applicable requirements outlined in this section.

Usability Requirements:

There are two approaches to demonstrate an acceptable level of usability for Climate Controls:

- Compliance with core prescriptive usability requirements **and** demonstration of an acceptable level of usability when evaluated against a performance-based usability test.
- Compliance with core prescriptive usability requirements **and** additional prescriptive usability requirements.

Note: EPA has identified usability as a critical feature to distinguish Climate Controls that are likely to save homeowners money from those that are not. A superior user experience means that consumers can easily, and reliably, translate their thermal preferences into an operating pattern that includes regular schedules, temporary deviations, and irregular occupancy.

EPA will provide parallel prescriptive and performance-based paths for usability qualification in order to balance ease of testing with allowing manufacturers the flexibility to innovate. Manufacturer comments on which requirements should be core requirements, and which should not, are welcome.

Requirements 1 thru 6 are core usability requirements that apply to **all** qualified product:

1. Climate Controls capable of controlling Heat Pumps shall include a standardized visual indicator labeled "back up heat" that appears whenever auxiliary heat is active.

Note: The backlit display requirement that appeared in the Draft 1 Version 2.0 Programmable Thermostat specification has been removed in this Version 1.0 document based on stakeholder concerns regarding incompatibility of the requirement with various display technologies.

Heat Pumps most commonly utilize inefficient electric strip heating elements as Auxiliary Heat, which consumes significantly more energy than the primary fuel source. Accordingly, EPA is requiring that Heat Pump compatible Climate Controls include a visual indicator, which will help to inform consumers of Auxiliary Heat usage periods.

2. The product shall store all programmed settings for the equipment it is designed to control in non-volatile memory in case of an external power outage or battery failure.
3. The product shall be capable of setting and maintaining the correct date & time without user input. When integrated into an EMS that includes time synchronization with external sources; EMS/ESI time synchronization shall take precedence.

Note: Correct execution of program schedules is dependent upon accurate timekeeping by the Climate Control. EPA is requiring that Climate Controls set and maintain correct date/time without user input. When integrated into an EMS, or utility AMI/DR system, time synchronization with the Communicating Climate Control is typically handled by the EMS or ESI.

4. The product shall offer the user a choice of operation in Fahrenheit or Celsius based on user preference. Temperature shall be displayed to a resolution of at least **1 degree Celsius** or 1 degree Fahrenheit.

480

481 **Note:** Stakeholders were concerned that displaying temperature on the Climate Control in 0.5 increments
482 will result in higher price points with little benefit to the consumer. Therefore, EPA is replacing the
483 requirement for a minimum 0.5 degree Celsius resolution with a 1 degree resolution.

484

485 5. The default Away Heat and Cool setpoints shall be 62°F and 85°F, respectively. The Away Heat
486 setpoint may be user configurable but not above 65°F. Similarly, the Away Cool setpoint may be
487 user configurable but not below 80°F.

488 **Note:** EPA understands the desire to allow these setpoints to be configurable but also needs to balance
489 this need with ensuring energy savings are not negated by the Away button

490

491 6. The product shall include a low-battery indicator that activates at least 2 months prior to critical
492 battery depletion. This requirement is only applicable to products that use batteries.

493 **Note:** EPA has retained a low-battery requirement to ensure that end users are adequately informed of
494 the need to replace thermostat batteries. This is particularly important for thermostats that require
495 batteries for basic functionality.

496 Qualified product must either comply with the usability testing requirement 7, below, or with the
497 additional prescriptive usability requirements 8 through 11.

498

499 7. The product must rate acceptably on a performance-based usability test.

500 **Note:** For the performance-based path, a draft Residential Climate Controls usability metric will be
501 released to industry stakeholders in July 2010, followed by an EPA hosted conference call in August 2010.
502 The metric will be designed to evaluate usability of Residential Climate Control schedule programming and
503 post-installation use. EPA is very interested in stakeholder comments and suggestions to encourage
504 enhanced usability by design and to evaluate usability of products. Comments regarding recommended
505 usability test methodology and specific tasks to be evaluated will be particularly valuable to EPA's efforts.
506 To encourage discussion, EPA has provided a broad outline for the performance based usability testing.

507 The performance path requires that panels of typical users achieve "success rates" for specified tasks.
508 Success may be defined by being able to achieve a task, or for some tasks, completing the task within a
509 given time limit. These tasks are:

- 510 • Initial set-up of CC (out of the box)
511 • Establishing a constant temperature
512 • Establishing a daytime/nighttime schedule
513 • Establishing a 5/2 schedule, with differing day and night temperatures
514 • Establishing a temporary, short-term, "away" setting
515 • Restoring the CC to a long-term schedule
516 • Ability to recognize present status of CC, e.g, which mode is enabled?

517 Success rates will be measured against a standard model, low-cost Climate Control. Usability metrics will
518 be based on improved success rates for the Climate Control under test above the success rates for the
519 standard model. This methodology is intended to allow comparison between products tested at different
520 times and places with different panels. EPA intends to use an off-the shelf Climate Control model as the
521 standard to allow timely release of this Version 1.0 Residential Climate Control specification.

522 An acceptable rating on the usability test will be a combination of success rates on the various tasks. The
523 combination may involve minimum performance levels on each task, an average performance level across
524 all tasks, or a combination.

Usability requirements 8 through 11, below, are required for a product that has **not** been evaluated to usability requirement 7, above.

8. The product shall include a single operation, such as a single button push, that triggers an energy saving mode. This mode shall simultaneously activate an energy saving setpoint and place the Residential Climate Control in Long Term Hold. The mode should be given a descriptive label; EPA recommends the use of the term “Away.”

Note: Climate Controls must provide both ease of programming and ease of manual set-back. Currently, dial-type mercury wetted relay manual thermostats are arguably easier to manually set-back than many programmable thermostats. In order to close this gap, EPA proposes an Away button requirement in this Draft 1 Version 1.0 specification. Away button functionality is intended to supplement programmed schedules, and enhance energy savings and usability, by providing easy access to an energy saving mode.

9. The product shall provide the user the ability to raise or lower the setpoint with a single button push. Setpoint changes made while in program mode shall activate a Short Term Hold indicator that informs the user that the change will be overridden by the program at the next scheduled change.

Note: EPA believes that requiring setpoint changes to be accomplished with a single button push drives usability. Also requiring a Short-Term Hold indicator to light when program setpoints are altered establishes consistent user notification for ENERGY STAR qualified Climate Controls. Therefore, Short Term and Long Term hold modes are proposed above to support the “Away” mode and single button push setpoint changes.

10. The product shall incorporate green, yellow and red LEDs (or an equivalent implementation using the same colors) to indicate current energy price tier, as follows:

Green – Off Peak
Yellow – Mid Peak
Red – On Peak

Note: EPA envisions the intuitive color-coded pricing indicators to be utilized when the Residential Climate Control is integrated into an EMS or enrolled in a utility Time of Use and/or Demand Response program. Proper utilization of these color-coded price tier indicators may require support by the EMS or ESI, as well as price tier and schedule data. The green, yellow, red color code aligns with similar implementations in a number of utility focused programmable communicating thermostats. Stakeholders are encouraged to provide feedback to EPA on this approach. Other utility variable pricing programs may require alternate methods for rate display on Climate Controls. EPA welcomes feedback from stakeholders on display requirements to facilitate energy savings based on these programs.

11. The product display shall have primary and secondary characters (i.e., numbers) that are at least 16mm and 4.75mm in height, respectively.

Note: Comments received on the Draft 1 Version 2.0 Programmable Thermostat specification recommended this requirement be replaced with a readability test, citing the effects of contrast, color and screen resolution on readability. These points are well taken, and EPA is open to changing the requirement if stakeholders know of a suitable test.

Also Note: EPA believes feedback when user input is accepted is a critical aspect of usability, but understands that in the realm of Climate Controls such a requirement may raise intellectual property issues. EPA is interested in stakeholder recommendations on how such a requirement may be suitably crafted.

Technical Requirements:

Note: The cycle rate requirement that appeared in the Draft 1 Version 2.0 Programmable Thermostat specification has been removed in this Version 1.0 document based on stakeholder concerns regarding applicability of Cycle Rate to HVAC efficiency.

12. The product shall be capable of maintaining room temperature within $\pm 1^\circ\text{F}$ of the setpoint temperature **in accordance with** NEMA DC 3-2008 section 4.5.2 Differential Tests. This may be a user configurable setting.

13. The product shall have access to outdoor temperature data. For Dual Fuel Heat Pump installations, the Residential Climate Control shall use the outdoor data to provide automatic cutover to/from the backup heat source based on installer configurable cutover temperatures.

Note: Outside temperature data is important for EMS and may be utilized by Climate Controls to intelligently vary the recovery period to ensure comfort temperature at the start of a comfort schedule period, while minimizing energy consumption and use of auxiliary heat.

14. The product shall include humidity **display** and be capable of maintaining desired humidity levels when coupled with suitable HVAC equipment. **Humidity sensing must be accurate to within $\pm 3\%$ with a long term drift of $< 0.5\%$. Line-Voltage Climate Controls are exempt from this requirement.**

Note: Humidity control is a key parameter for maintaining user comfort. When properly implemented, this feature can reduce energy consumption by maintaining user comfort at a higher cooling setpoint. Accuracy is specified to provide a reasonable tolerance for humidity display. Stakeholders are encouraged to provide feedback on the accuracy requirement.

15. The product shall be equipped with installer selectable recovery algorithms. When configured for non Heat Pump HVAC installations, the default recovery algorithm shall comply with the definition for Recovery, Adaptive (Section 1A). When configured for Heat Pump or Dual Fuel Heat Pump installations, the default recovery algorithm shall comply with the definitions for Recovery, Adaptive **and** Recovery, Heat Pump with Auxiliary Heat (Section 1A).

Note: Default recovery algorithms vary in currently available programmable thermostats. By requiring ENERGY STAR Residential Climate Controls to utilize adaptive recovery as the default for all HVAC systems, EPA strives to both ensure that comfort setpoints are attained when scheduled and drive operational consistency amongst ENERGY STAR qualified products.

16. The product shall consume no more than 0.5 watts of power in any operational mode. For Communicating Climate Controls, compliance with this limit applies only to the Residential Climate Control; it does not apply to the Residential Climate Control with installed and/or active communication capability.

Note: In the Draft 1 Version 2.0 Programmable Thermostat specification, EPA requested suggestions regarding a maximum energy consumption limit. In response to minimal feedback on an appropriate limit, EPA is proposing 0.5 watt. Stakeholders are encouraged to comment on this new proposal.

17. All Residential Climate Control models shall comply with Restriction of Use of Hazardous Substances (RoHS) regulations for lead and mercury.

18. Residential Climate Controls shall be shipped from the factory with schedule period setpoints as specified in Table 1 below. For a specific example of acceptable schedule times and setpoints, see Table 2 below.

Table 1: Residential Climate Control Setpoints

Setting	Setpoint (Heat)	Setpoint (Cool)
Morning	$\leq 70^{\circ}\text{F}$	$\geq 78^{\circ}\text{F}$
Day	Set-back at least 8°F	Set-up at least 7°F
Evening	$\leq 70^{\circ}\text{F}$	$\geq 78^{\circ}\text{F}$
Night	Set-back at least 8°F	$\geq 78^{\circ}\text{F}$

Table 2: Residential Climate Control – Acceptable Schedule Periods and Setpoints

Setting	Time	Setpoint (Heat)	Setpoint (Cool)
Morning	6 a.m.	70°F	78°F
Day	8 a.m.	62°F	85°F
Evening	6 p.m.	70°F	78°F
Night	10 p.m.	62°F	78°F

Note: To ensure clarity and consistency for consumers with varying home/away schedules, EPA has revised schedule period terms to: "Morning - Day - Evening - Night"

In response to stakeholder feedback indicating that 82 degrees is too uncomfortable for homeowners, leading them to bypass the ENERGY STAR settings, EPA is proposing to relax the default cooling setpoint temperature for the "Night" schedule period to 78 degrees Fahrenheit.

626 **Communication Requirements:**

627 **Note:** EPA envisions availability of communication modules to support various protocols that enable
628 interoperability across a wide range of EMS and ESI devices, including Utility Load Control and/or
629 Demand Response enabling devices. EPA is monitoring related standardization activities and encourages
630 stakeholders to contribute to open standards activities and participate in organizations that are developing
631 specifications for universal communication modules.

632 The purpose of this requirement is to provide support to the uploading of data to, and remote control by,
633 EMS, ESI and other external devices. EMS implementations will, at a minimum, provide dramatically
634 increased insight into energy usage to encourage voluntary reduction of energy consumption and increase
635 energy efficiency. In addition, availability of detailed thermostat data will enable groundbreaking
636 applications that take **automatic action** to increase energy efficiency, decrease energy expense, and
637 enable early detection of HVAC or building envelope faults or deficiencies.

638 19. A Software Development Kit, or Interface Control Document, as appropriate, shall be available to
639 3rd party developers to enable open access to the product's full range of communication and
640 remote control capabilities.

641
642 20. Where suitable open communication standards exist, they must be used.

643
644 21. The product shall facilitate secure communications, including:

- 645 • Basic authentication and authorization so that only authorized devices or software applications
- 646 can access the product.
- 647 • Security measures to protect against unauthorized access.

648 **Note:** By requiring basic security and release of communicating interface documentation, EPA intends to
649 facilitate full access to Climate Control communication capabilities to 3rd party developers, while
650 preventing unauthorized access. This will facilitate interoperability between various EMS devices and
651 increase rates of adoption.

652 22. Capability for an authorized device or software application to retrieve thermostat settings and data
653 points on a periodic basis (which should include the ability to record each data point below at least
654 every 60 seconds and transmit the data at least every 5 minutes). Retrievable Comfort Control
655 settings and data, include:

- 656 • Unique Thermostat ID
- 657 • Room Temperature in °F or °C (0.1 °F resolution)
- 658 • Active Cool and Heat setpoints in °F or °C
- 659 • HVAC mode setting (off, Heat, Cool, auto)
- 660 • Active HVAC mode (off, Heat, Cool)
- 661 • Fan mode setting (off, on, auto)
- 662 • Active Fan mode (off, on)
- 663 • Current Hold mode type and state (e.g. Long Term – on)
- 664 • Current Away mode status (on, off)
- 665 • All Programmable settings, including program schedules & setpoints, hold modes, fan modes,
- 666 HVAC modes and installer settings.
- 667 • Current Humidity reading and control mode

668 **Note:** The above communication requirements ensure that energy management systems and software
669 applications that capture, store, display and analyze Climate Control data have access to relevant data at
670 an acceptable frequency. These creative applications, current and future, will enable both *voluntary*
671 energy use reduction through energy usage information and *automatic* energy use reduction based on
672 price or other triggering events. EPA encourages stakeholder feedback on whether these and other
673 settings and data are appropriate.

23. Capability for an authorized device or software application to make near-real time (within roughly 5 seconds) settings changes to the following thermostat settings at any point of time:

- Time synchronization
- Active Cool and Heat setpoints in °F or °C
- HVAC mode (off, Heat, Cool, auto)
- Fan mode (off, on, auto)
- Select hold mode type and status (e.g. Long Term – on)
- Select away mode status (on, off)
- Control (green, yellow, red) energy tier indicators
- All program schedule settings including times and setpoints for active and inactive schedules
- Select active program schedule

Note: Remote control of Climate Controls will enhance user convenience and facilitate energy savings. For example, in an unplanned away period, Away Mode may be activated from the consumer's mobile device. On the return home, the consumer can leverage the mobile device to cancel vacation hold and activate the normal program settings. The above communication requirements ensure that Climate Controls are capable of being remotely controlled in a responsive manner. Sources for control signals include: (1) customer signals from home computer or mobile device; (2) utility price signals and display messages; and (3) home energy management device signals.

Ease of Installation Requirements:

24. Installation instructions must utilize graphics and text, as appropriate, to guide the installer through both installation and configuration of the Residential Climate Control. These instructions shall include necessary installation steps and connection diagrams for all supported HVAC systems, both heat pump and non heat pump.

25. Installer documentation must be posted on the manufacturer's Web site in electronic format and must be available for at least 10 years after cessation of product manufacture.

Note: The "no new wires" installation requirement that appeared in the Draft 1 Version 2.0 Programmable Thermostat specification has been removed in this Version 1.0 document based on stakeholder concerns regarding the viability of the requirement.

Documentation requirements have been moved under Ease of Installation and apply only to Climate Control installation. EPA is encouraging development of Climate Controls that are intuitive and simple to use and program. These Climate Controls will not require the user to consult written documentation in order to use and program the product. Thus there are no requirements for user documentation.

26. HVAC wiring terminal designations of Low Voltage Climate Controls shall comply with Table 5-1 in NEMA DC 3-2008. Line Voltage Climate Controls shall be marked to identify the Line, Load and Earth terminals. Low Voltage Climate Controls that utilize wired or wireless digital data interfaces between the Climate Control and the controlled HVAC equipment shall be exempt from this requirement.

Note: EPA recognizes the potential energy savings from advanced control of Line-Voltage HVAC equipment and has revised the above requirement to enable qualification of these products. EPA also recognizes the benefits of advanced, digital data communication between the Climate Control and the controlled HVAC equipment and encourages timely adoption by Climate Control stakeholders. Benefits of these advanced HVAC control protocols include: (1) advanced control over existing wiring; (2) auto-configuration to ensure easy and correct configuration that optimizes energy efficiency; and (3) fault detection and alerting to help ensure peak ongoing operating efficiency. As such, an exemption is proposed for controls that use digital data links for HVAC equipment control.

27. The product shall use commonly available batteries free of special handling and/or hazardous waste disposal requirements. This requirement is only applicable to products that use batteries.

722
723 28. The product shall be designed for a typical battery life of a minimum of 12 months. This
724 requirement is only applicable to products that use batteries.

725 **Note:** EPA has reduced the specified battery life requirement from 18 to 12 months. Based on
726 programmable thermostat manufacturer input, a 12-month battery design life more closely aligns with
727 consumer expectations compared to the previously proposed 18 months.

728 729 730 4) Test Criteria

731 **Note:** With the implementation of the enhanced qualification and verification requirements, products will
732 need to have test data demonstrating compliance with these requirements. At that time, an appropriate
733 test method will be developed.

734 735 5) Effective Date

736
737 The date that products must meet the requirements specified under the Version 1.0 Residential Climate
738 Controls specification will be defined as the *effective date* of the agreement. The ENERGY STAR Version
739 1.0 specification for Residential Climate Controls shall go into effect on **October 1, 2010**. All products
740 must meet the requirements presented in Sections 2 – 4, above, to qualify for ENERGY STAR.

741
742 **Grandfathering:** When ENERGY STAR specifications are revised, EPA does not automatically grant
743 continued qualification to products submitted under previous specification versions. Any product sold,
744 marketed, or identified by the manufacturing Partner as ENERGY STAR must meet the specification in
745 effect on the date of manufacture of the product.
746

747 **Note:** EPA is continuing to work toward a Final Version 1.0 specification by September/October of this
748 year. Therefore, an October 1, 2010 effective date is proposed, above. This effective date represents the
749 date in which manufacturers may begin labeling and promoting qualified Residential Climate Controls as
750 ENERGY STAR qualified. Since Climate Controls represent a new ENERGY STAR product category,
751 partnering manufacturers will be able to immediately submit products that meet requirements of the
752 Eligibility Criteria to EPA for review and qualification. Stakeholders are encouraged to provide feedback
753 on this proposed date.

754 EPA will not allow grandfathering under this Version 1.0 specification. EPA considers Residential Climate
755 Controls to be a new ENERGY STAR program. Products that were qualified under the old Version 1.2
756 Programmable Thermostat specification will need to meet the requirements of this Version 1.0
757 specification and be resubmitted for ENERGY STAR qualification. Manufacturers will also need to resign
758 onto the program as ENERGY STAR partners.

759 760 6) Future Specification Revisions

761
762 ENERGY STAR reserves the right to change the specification should technological and/or market
763 changes affect its usefulness to consumers or industry or its impact on the environment. In keeping with
764 current policy, revisions to the specification will be discussed with stakeholders. In the event of a
765 specification revision, please note that ENERGY STAR qualification is not automatically granted for the life
766 of a product model. To qualify as ENERGY STAR, a product model must meet the ENERGY STAR
767 specification in effect on the model's date of manufacture.