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November 27, 2009

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Washington, DC 20460

Dear Katharine,

Thank you for the opportunity to provide the following comments on behalf of Honeywell International on Draft 1 of the Version 2.0 Programmable Thermostat Specification for ENERGY STAR.

While we are pleased that EPA recognizes the importance and value of the ENERGY STAR program for these products and is willing to work with stakeholders to put a new specification in place as soon as possible, we are concerned with the approach taken with Draft 1. In particular, we believe that the proposed draft will add cost by adding features that are not needed by most consumers, stifles industry innovation through design constraints, and represents a step backwards in achieving energy savings via this category of products.

For example, the Agency states that "EPA is aware of some programmable thermostats that have all of the features proposed in the enclosed Draft 1 Version 2.0 specification and many others that have some of these features." However, according to market research, as confirmed in our discussion during the recent Webinar on November 18th, the only products that may qualify for ENERGY STAR certification, if EPA implements the Draft 1 requirements as proposed, sell for over \$250 each, not including installation costs. We are concerned that if this is the price point for ENERGY STAR thermostats, most homeowners would be unable or unwilling to purchase them. Low income homeowners will be unlikely to invest in a large upfront capital expense, even if the payback period is relatively short. EPA has tried to craft Version 2.0 as an aspirational specification, intended to give manufacturers a target to shoot for. We are familiar with other programs in which ENERGY STAR has set "Tier 2" requirements, allowing manufacturers 18 months or longer to design new products to meet ENERGY STAR requirements and transform the market. However, the approach taken in Draft 1 is to set Tier 2-type requirements as the main specification effective December 31, 2009.

In addition, the configuration of the thermostat that would result from Draft 1 far exceeds the requirements of the majority of homeowners. The high price point would drive people away from such an energy saving device. In addition, many of the requirements stated in this commitment are protected with a "forest of patents." All partners would need to either disclaim ownership or allow a license.

We applaud EPA's interest in retaining the program and moving forward, but the timeline proposed in Draft 1 is not supportable.

The following are detailed section-by-section comments on Draft 2 Section 1, Definitions

C. Low Voltage Thermostat. The description of the circuit would be more precise if it said NEC Class 2. The definition of a Class 2 circuit is found in the National Electrical Code (NEC).

P.1, 2, and 3.Recovery Systems. EPA should use the NEMA DC-3-2008 definitions for Recovery, Conventional; Recovery, Adaptive; and Recovery, Heat Pump with Auxiliary Heat. We recommend that EPA not use the terminology "Pre-Comfort" Recovery; it is not the usual industry terminology.

Additional Definitions: We suggest EPA add the following definitions for terms in the specification.

Operating Differential is an industry standard definition for room air temperature swing. It is defined in NEMA DC-3-2008: "The difference between cut-in and cut-out points as measured at the thermostat under specified operating conditions."

Room Temperature Droop should be added as a functional requirement. It is defined in NEMA DC-3-2008: "The deviation in the cut-in point that results from a change in the duty cycle, heating load, or cooling load."

Section 2, Qualifying Products

Line 307: compatibility with heat pumps up to 3 stage heat – 2 stage cool. This requirement implies a minimum of six relays, and will only be used on a small fraction of the systems sold now and in the foreseeable future. The cost of these unused relays will drive up the cost to the distributor and ultimately, the consumer, making them less willing to purchase this energy saving product.

Line 310: Exclusion of line voltage thermostats is unwarranted. The rationale given by EPA during the November 18 webinar was that line voltage thermostats are used primarily to control baseboard heating, which EPA claims is inefficient and should not have access to an ENERGY STAR labeled programmable thermostat.

However, U.S Department of Energy studies (source; http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520), state that electric resistance heating converts nearly 100% of the energy in the electricity to heat. In fact, as mentioned in the article, a central system is less efficient than a zoned electrical heating system because of the additional energy required to distribute the heated air through the home (fan required), and because of the losses through the ducts and in unoccupied rooms.

In electrical zoned heating, the key element to enable energy savings is the thermostat. Excluding it from the specification would be a step backward, which will not promote the purchase of better controls to achieve energy savings for these applications.

Based on research (from the Energy Information Administration (EIA) and Resource Canada reports), in North America, 9 million houses are using electrical permanent heaters (ex. baseboards) as primary heat and 2.5 million are using electrical permanent heaters as secondary heat. Assuming that a typical house uses an average of 6 thermostats (zoned house), the installed base is probably in the range of 60 millions line volt thermostats. The majority of these installations are using bimetallic thermostats. These provide bad temperature controls (high temperature swings) and cause inefficiency and higher energy consumption. Therefore, the EPA should consider promoting electronic line volt thermostats to facilitate the conversion of these bimetallic thermostats, resulting in 10% energy savings when using a non-programmable electronic line volt thermostat (source Hydro Québec; <http://www.hydroquebec.com/residential/thermostats/economies.html>) and an additional 4.5% energy saving when using a programmable version.

If EPA believes that a certain heating or cooling technology is inefficient, it has reason to refuse to construct an ENERGY STAR program for that technology. With this specific program, however, ENERGY STAR is focusing on labeling programmable thermostats only, not HVAC systems. Consumers have reasons, including indoor air quality management, for using baseboard heating over forced air. U.S. consumers should be able to purchase an ENERGY STAR programmable thermostat for these applications.

Part A, Line 313

The product must provide by default a pre-programmed 5-2 (weekday – weekend) program schedule with a minimum of four possible schedule periods (i.e., wake, day, evening, and sleep). Day and sleep periods must be at least 8 hours in duration.

We believe the requirement should establish 5-2 day programming as a minimum requirement. A 7-day or a 5-1-1-day are more flexible and would meet the requirement. The current proposal indicates that even a very flexible thermostat would need to default to a de-featured setting of a 5-2 day.

We suggest that EPA rewrite as the proposal as: “The product must have a pre-programmed schedule of 5-2 day, 5-1-1 day or 7-day programmable.”

EPA should use the industry definitions for energy saving mode. The Draft 1 description of Day and Evening are restrictive to persons who do not have “day jobs”. The most descriptive periods are Wake, Leave, Return, and Sleep. These fit any type of work schedule.

Part B, Line 317

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., wake, day, evening, and sleep). Day and sleep periods must be at least 8 hours in duration.

Requiring an entry level thermostat such as a 5-2 day thermostat to have a choice of a 5-1-1 day and/or a 7-day programming as an option destroys the market value for more advanced models and stifles innovation. The industry prices thermostats with more features at a higher price. Similar to the automobile industry, the features on a Cadillac are not available on a Chevrolet Cavalier. Therefore, we recommend that EPA delete the requirement for entry level thermostats to have this option, or modify the wording in Section 2 Part A to require the thermostat to support at least a 5-1-1 day programming.

With Parts A and B, this product must provide one or more user selectable programs. This is an unnecessary complication that provides no more value than a 7 day programmable unit.

Part C, Line 322

The product must be compatible with most HVAC systems including both Heat Pump and conventional HVAC systems up to and including 3-stage heat / 2-stage cool plus humidity control.

Most homes do not have 3 stage heat and 2 stage cool heating and air conditioning systems. For standard forced air systems, the majority of homes have a 1-stage heat and 1-stage cool system, and the majority of heat pumps are single stage with 1-stage of electric back-up. Requiring homeowners to pay for functionality they do not need or will not benefit from is wasteful. Consumers who only need a single stage system thermostat will be lured into buying a thermostat that has added cost because they think the ENERGY STAR logo is providing

addition value. In this case there is no additional [energy savings] benefit, just higher cost, additional installation complexity and increased traffic to the industry call centers.

Regarding humidity control, only a small percentage of homes in the U.S. require a humidifier or dehumidification. These applications are regional. Therefore, customers who do not need these options are paying additional price with no value at all. Humidification and dehumidification adds significant cost to the thermostat, assuming the customer has the wiring to support such features. This item should be optional and not a requirement in the specification.

Part D, Line 325

The product must interface with external temperature sensors and control Dual Fuel Heat Pump systems.

Dual fuel systems are very regional. The large majority of homeowners will receive no benefit, only additional overhead, to support this functionality. This type of system is a furnace with a heat pump combined. This is popular in the mid section of the U.S. The added cost to the system is related to the support for the outdoor sensor (circuit and connectors).

We recommend that this requirement should be optional and not required.

Part E, Line 328

The product must be upgradeable to a PCT by installation of a HAN communication module.

There is currently no market for such a feature. Requiring manufacturer's to support a HAN interface on a thermostat adds little value for the customer. However, this may be a useful feature in the future when utilities begin to add thermostats to their HAN networks. (The standards for the Smart Grid are still undefined.)

It is doubtful that any currently available products can meet the requirement of being upgradable to a PCT by 12/31/09. This is a future requirement and adding this feature to a thermostat adds significant cost to a thermostat while delivering zero energy savings or value to the homeowner.

This feature should be removed and added at a later time when HAN networks are defined and deployed in significant numbers to provide homeowner value.

Section 3, Specifications for Qualifying Products

Part A, Tier 1 Program Requirements

Paragraph 1, Line 359

The product shall include a single click or a single button push that triggers an energy saving mode. This mode shall simultaneously activate the energy savings setpoint temperature and place the thermostat in Long Term Hold. This hold shall remain active until cancelled by the user. The mode should be given a descriptive label. EPA recommends the use of the term "Away".

Programmable thermostats that are designed correctly do a much better job at managing holds and temporary hold than this method. For example, certain models on the market today provide timed holds that are much simpler to operate than the proposal describes. Adding such

a requirement would destroy good user interfaces and set ease of use innovations backwards. We strongly believe that ENERGY STAR should not be designing the thermostat for the manufacturers. This is too prescriptive and restricts the flexibility to design a good user interface.

We recommend that EPA remove this requirement from the specification.

Paragraph 4, Line 379

The product shall have a backlit display. The backlight of the display shall power off after XX minutes of user inactivity.

Many thermostats on the market have a setting for constant backlighting in order to make the display more readable in low light conditions. Requiring the thermostat to remove this feature would reduce the readability of the thermostat and be a step backward in readability and ease of use. We recommend that EPA removes the requirement for the backlight to turn off after a certain amount of time.

Alternatively, EPA should allow for a low-level constant backlight. If a model does not have a constant backlight, but does have a temporary backlight function, the recommended duration should be around 5-10 seconds to prevent unnecessary draining of the batteries.

Paragraph 5, Line 384

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

The proposed size of 4.75mm is much too large to display secondary characters. On a fixed segment display, if every word was that large, either ease of use would be impacted severely or the display would need to be very large, adding significant cost to the thermostat. There are no thermostats on the market today that are close to this font size.

Recommend a 10pt. font (approx 2mm) for secondary font.

Paragraph 5, Line 384

The minimum height of the display numerals of 16 mm is restrictive. A more flexible minimum height would be 9.5 mm.

Paragraph 6, Line 387

The product shall inform the user when a modification to programmed settings by the user has been accepted.

This feature is covered by intellectual property and can not be a requirement in this specification. We urge EPA to remove this requirement from the specification.

Paragraph 8, Line 393

The product shall be capable of retrieving standard time signals and resetting its internal clock based on those signals.

This feature is not required to keep the time correct. On correctly designed thermostats setting the time and day is simple and the thermostat is able to maintain the time through power outages. Adding a radio receiver to maintain the clock is added cost with little customer benefit.

We recommend rewriting the requirement to read the thermostat will retain its clock setting for a minimum of 4 hours when power is lost and batteries are not used.

Paragraph 9, Line 396

Almost every thermostat sold in this country is set to the F scale. The display area that would be consumed by the 0.5 resolution for Celsius will increase the cost of the display unnecessarily.

Paragraph 10, Line 409

The product shall maintain room temperature within $\pm 2^{\circ}\text{F}$ of the setpoint temperature when tested to NEMA DC 3-2008 section 4.5.2 Differential Tests.

We recommend that this requirement have a heading "Operating Differential" and be defined as specified earlier in these comments and tested to NEMA DC-3-2008.

Of all of the added changes to the specification, the best way to reduce energy is to use a thermostat with low droop and overshoot. Customers also can sense an ambient change of more than 2 degrees F.

We strongly recommend rewriting the requirement to read: "The product shall maintain room temperature within ± 1 degree F of the setpoint temperature when tested to NEMA DC 3-2008, Section 4.5.2, Differential Tests."

In addition, as noted above, we recommend that the specification include a requirement for Room Temperature Droop: The Room Temperature Droop shall not exceed 1.5°F when tested to NEMA DC-3-2008, Section 4.5.4.

Paragraph 11, Line 412

The product Cycle Rate shall be less than 5 cycles per hour when tested to NEMA DC 3-2008 413 section 4.5.3 Cycle Rate Test conducted at a 50% duty cycle.

Different equipment requires different cycle rate settings. The cycle rate setting should be matched with the specific equipment type. Most thermostats allow a range of 1 CPH (Cycles per Hour) to 12 CPH to match the appropriate system type. For example, an electric furnace or a heat pump with auxiliary back up requires 9 CPH due to the mass of the heat exchanger. This requirement is not based on a good understanding of system types and should be removed. There should be no mention to cycle rate in the specification and the focus should be on minimizing swing by requiring ± 1 degree of temperature swing.

Paragraph 12, Line 415

The product shall include the ability to interface with an optional outdoor temperature sensor. For Dual Fuel Heat Pump installations, the thermostat shall use the outdoor sensor to provide automatic cutover to/from the backup heat source based on installer configurable cutover temperatures.

Dual fuel systems are very regional. The large majority of homeowners will receive no benefit, only additional cost, to support this functionality. Typically, these dual fuel systems consist of a furnace with a heat pump combined. While prevalent in the mid section of the US, it is not prevalent in the rest of the country. This raises the cost of the system to support the outdoor sensor (circuit and connectors).

We recommend that this requirement is optional and not required.
Paragraph 13, Line 420

We recommend changing the language to delete "Heat Pump and Pre-Comfort" and replacing them with "and Adaptive".

On line 423, pre-comfort (recovery) is enabled by default. This "feature" is one of the largest sources of consumer complaints and confusion that thermostat manufacturers encounter. We recommend striking this provision.

Paragraph 14, Line 425

The product shall include humidity control and be capable of maintaining desired humidity levels when coupled with suitable HVAC equipment.

Only a small percentage of homes in the U.S. require a humidifier or dehumidification. Draft 1 does not specify if humidification or dehumidification or both are/is required. These applications are regional. Therefore, customers who do not need these options are paying an additional cost for no additional value. Humidification and dehumidification adds significant cost to the thermostat (humidity sensor, output relays circuits), assuming the customer has the wiring to support such features. In addition, the fact that dehumidification tends to use more energy than humidification was not considered. Adding this feature(s) increases level of complexity for the user when ENERGY STAR is trying to establish a "usability metric". We recommend that this item is optional and not a requirement in this specification.

Paragraph 16

The specification of RoHS compliance for mercury content is unclear. Please clarify whether EPA is referring to the European Union's Directive, which is not a U.S. legal instrument but is only amendable by decision-makers in Europe or whether EPA is referring to another specific "RoHS" set of requirements set elsewhere?

Paragraph 17, Set Point Temperatures

Line 441: 82 degrees for a setback in Cool at night will lead to consumers disabling this device. If EPA and DOE are planning on studying usability, we recommend the study should find out what percentage of users are willing to adopt the 82 degree night time setting for cooling. This has always been an issue for users with the preprogrammed settings. This was one of the original tenets of the ENERGY STAR thermostat program - if the user set time and day and hit "run program" they got instant energy savings. Instead, it became one of the reasons the users didn't use programming and opted for the hold button. We recommend returning to the previously suggested temperature of 78 degrees night setback.

The tables do not include acceptable Set Point Times and Temperatures for weekends. The tables from the draft NEMA Annex to DC-3 should be included. Also, Honeywell recommends that the Tables be based on period designations of Wake, Leave, Return, and Sleep.

Honeywell also recommends that the Cooling setpoint temperatures for Leave should be 82° F and for Sleep should be 75° F.

**Table 1
Programmable Thermostat Setpoint Temperatures**

Setting	Setpoint Temperature (Heat)	Setpoint Temperature (Cool)
Wake	70°F (21.1°C)	78°F (25.6°C)
Leave	setback at least 8°F (4.4°C)	setup at least 4°F (2.2°C)
Return	70°F (21.1°C)	78°F (25.6°C)
Sleep	setback at least 8°F (4.4°C)	75°F (23.9°C)

**Table 2
Acceptable Weekday Setpoint Times and Temperature Settings**

Setting	Time	Setpoint Temperature (Heat)	Setpoint Temperature (Cool)
Wake	6 a.m.	70°F (21.1°C)	78°F (25.6°C)
Leave	8 a.m.	62°F (16.7°C)	82°F (27.8°C)
Return	6 p.m.	70°F (21.1°C)	78°F (25.6°C)
Sleep	10 p.m.	62°F (16.7°C)	75°F (23.9°C)

**Table 3
Acceptable Weekend Setpoint Times and Temperature Settings**

Setting	Time	Setpoint Temperature (Heat)	Setpoint Temperature (Cool)
Wake	8 a.m.	70°F (21.1°C)	78°F (25.6°C)
Leave	10 a.m.	62°F (16.7°C)	82°F (27.8°C)
Return	6 p.m.	70°F (21.1°C)	78°F (25.6°C)
Sleep	10 p.m.	62°F (16.7°C)	75°F (23.9°C)

Paragraph 18, Line 451

The product shall use HAN communication modules featuring standardized, low-power, low bandwidth HAN communication protocols.

There is currently no market for such a feature. Requiring manufacturers to support a HAN interface on a thermostat adds little value for the customer. However, this may be a useful feature in the future when utilities begin to add thermostats to their HAN networks. (The standards for the Smart Grid are still undefined.)

Utilities recently have overcome an impediment to a key component for energy savings feedback. The recent foray by utilities into demand/time based pricing will give the customer the incentive to actively monitor their energy usage. Adding a HAN port that will not be usable by the majority of the country for the next 10 years results in unnecessary additional costs. This is a future requirement and adding this feature to a thermostat adds significant cost to a thermostat while adding no energy savings or value to the homeowner.

We recommend that EPA remove this feature and, revisit the specification at a later time when HAN networks are defined and deployed in significant numbers to provide homeowner value.
Paragraph 19, Line 454

The product shall log and retain usage data. Under typical usage, the thermostat shall retain data for the most recent 7-day period. This data shall be displayable on the thermostat and downloadable when integrated into an energy management system.

There is no energy savings achieved by seeing 7 days worth of usage information on the thermostat display. The homeowner has no context for analyzing this data. For example, if a homeowner viewed on the thermostat that their furnace or air conditioner ran 400 minutes on Monday, 380 on Tuesday, 401 on Wednesday, 325 on Thursday etc. and the schedule was the same for each day, what is gained from such a feature?

We recommend that EPA redraft this provision to provide for a feature that helps the customer manage their energy usage. For example: month over month energy use, or year over year energy usage. However, we strongly believe that more VOC (Voice of the Customer) research should be done here to better define the requirements before adding a feature in this area.

Paragraph 25, Line 485

The product shall incorporate features to facilitate "no-new-wires" installation in retrofit applications where no common wire is available at the thermostat location.

It is unclear why EPA has included this feature in the ENERGY STAR specification. Some products require a 24 Vac common to operate, specifically those products with advanced communication ability such as those thermostats used for utility systems demand response programs. This feature will significantly curtail that functionality and should be removed.

Paragraph 27, Line 491

The product shall be designed for a typical battery life of a minimum of 18 months. This requirement is only applicable to products that use batteries.

The typical battery life for battery operated electronic thermostats is 12 months. We recommend rewriting the requirement to call for a standard, readily available 12 month battery. An 18-month battery life is "feature-creep" that adds cost and should be changed.

Conclusion

It is clear that EPA was seeking, with Draft 1, to "push the envelope" and challenge manufacturers to make choices about the proper requirements and performance of an ENERGY STAR qualified programmable thermostat in 2010. While we commend the effort, we respectfully request EPA to incorporate our suggested changes into Draft 2 of Version 2.0.

We look forward to working with you and the Agency to make Version 2.0 truly of value to U.S. residential energy consumers seeking to better manage and reduce their energy consumption, while achieving a comfortable climate inside their homes at an affordable price.

Sincerely,

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