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November 27, 2009

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Thank you for the opportunity to provide the following comments on behalf of the member companies of the NEMA Residential Controls Section 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 disappointed with the approach taken by EPA with Draft 1.

In the Draft as circulated for comment, EPA stated "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, to our knowledge that there are no products on the market today that would be able to qualify for the Energy Star if the Draft 1 requirements were implemented as proposed. This was confirmed during the November 18 webinar, during which two companies stated that specific models on the market now could not meet the proposed requirements now but could be able to qualify if appropriate software upgrades could be made to them.

EPA has not billed Version 2.0 as an aspirational specification, intended to give manufacturers a target at which 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 and to propose setting actual Tier 2 requirements for 18 months later, July 1, 2011.

In addition, as discussed on the November 18 webinar, the configuration of the thermostat that would result from Draft 1 far exceeds the requirements of most homeowners. We believe strongly that the high price point required for a product that could be proven to meet all requirements of Draft 1 would drive people away from this energy saving device. In addition, many of the requirements specified in Draft 1 are protected with a "forest of patents". All partners would need to either disclaim ownership or allow a license. The entire specification should be reviewed thoroughly from an intellectual property standpoint before being finalized.

Is EPA comfortable with re-launching a program nationally in which only two companies are prepared to offer product for potential qualification for the Energy Star mark and in which the only qualified products will be loaded with costly features that offer little real additional usability or functionality to most U.S. consumers to control their comfort and reduce their energy usage

based on the heating, ventilation and air conditioning systems now operating in most U.S. homes?

We welcome and applaud EPA's interest in retaining the Energy Star program for programmable thermostats and moving forward to set new requirements to differentiate products and provide for energy savings, but the approach proposed in Draft 1 is not supportable by EPA or by industry.

The following are detailed section-by-section comments on Draft 1, Version 2.0.

Section 1, Definitions

C. Low Voltage Thermostat. The circuit description would be more correct 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. EPA should scrap the terminology "Pre-Comfort" Recovery. It is not industry language.

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 unjustified. The rationale given by EPA during the November 18 webinar was that line voltage thermostats are primarily used to control baseboard heating, which EPA claims is inefficient and should not have access to an Energy Star labeled programmable thermostat.

EPA should refrain from overreaching. 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. However, with this program Energy Star is proposing to label 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 that will control their central heating or cooling system.

EPA must also consider high efficiency heating/cooling systems that meet current Energy Star efficiency and performance standards with the aid of the integral thermostat which meets the current Version 1.1 thermostat specification. Energy Star should grandfather these thermostats into any new specification based on the overall high efficiency provided by these integrated systems.

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 be written such that a 5-2 day programming is a minimum requirement. A 7-day or a 5-1-1-day are more flexible and would meet the requirement. The way it is worded would indicate that even a very flexible thermostat would need to default to a de-featured setting of a 5-2 day.

Rewrite 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. The industry prices thermostats with more features at a higher price. Similar to the automobile industry, the features on a "high-end" model are not available on a base, lower priced model.. Therefore requiring the entry level thermostat to have this option should be removed, or changed so the wording in Section 2 Part A requires 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 of 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 in any way is waste. 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 value added, just additional cost, added installation complexity and increased calls to industry's 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. Adding the overhead to support this functionality is waste for 95% of homeowners. This type of system is a heat pump with a heat pump combined. This is popular in the mid section of the U.S. The cost adder to the system is the support for the outdoor sensor (circuit and connectors).

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 zero value for the customer. 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 highly 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 adding zero energy savings or value to the homeowner.

This feature should be removed and added at a later time when the National Institute for Standards and Technology and the Federal Energy Regulatory Commission have adopted the applicable standards and 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 the certain models on the market today provide timed holds that are much simpler to operate than this feature describes. Adding such a requirement would destroy good user interfaces and send ease of use backwards. Why is Energy Star designing the thermostat for the manufacturers? This is way too prescriptive and makes designing a good user interface restrictive.

This requirement should be removed 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. Requiring the backlight to turn off after a certain amount of time should be removed from the specification.

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 severely impacted or the display would need to be very large, adding significant cost to the thermostat. There are no thermostats on the market today that even come close to this font size.

We recommend a 10pt. font (approx 2mm) for the secondary font.

Paragraph 5, Line 384

The minimum height of the display numerals of 16 mm is too restrictive. A more reasonable 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. EPA should 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 in 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 almost zero customer benefit.

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 ± 2°F of the setpoint temperature when tested to NEMA DC 3-2008 section 4.5.2 Differential Tests.*

This requirement should have a heading "Operating Differential" and be defined as specified earlier in these comments and tested to NEMA DC-3-2008: "The difference between cut-in and cut-out points as measured at the thermostat under specified operating conditions."

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

We strongly recommend rewriting the requirement to read: "Operating Differential: The product shall maintain room temperature within 2 degrees F of the setpoint temperature when tested to NEMA DC 3-2008, Section 4.5.2, Differential Tests."

EPA has expressed a concern that restricting operating differential to 2 degrees would result in higher cycle rates and greater energy usage. As discussed below, some HVAC technologies, such as electric furnaces, require higher cycle rates to maintain reasonable operating differential.

In addition, as noted above, the specification should 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. Some form of cycle rate control is required in the thermostat design in order to meet the maximum operating differential of 2 degrees F that we propose in all application conditions. Some manufacturers use Cycle Rate Control Adjustments to attain this and some use Adjustable Thermostat Differential to achieve the same control on room temperature swing. 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.

EPA's proposed 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. Adding the overhead to support this functionality is waste for 95% of homeowners. This type of system is a heat pump with a heat pump combined. This is popular in the mid section of the US. The cost adder to the system is the support for the outdoor sensor (circuit and connectors).

This requirement should be optional and not required.

Paragraph 13, Line 420

Change the wording to delete "Heat Pump and Pre-Comfort" and replace 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 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 price with no value at all. 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, EPA does not consider that dehumidification tends to use more energy than humidification. Also adding this feature(s) add another level of complexity for the user when Energy Star is trying to establish a "usability metric". This item should be optional and not a requirement in this specification.

Paragraph 16

The specification of RoHS compliance for mercury content is vague. Is EPA referring to the European Union's Directive, which is not a U.S. legal instrument but is only amendable by decisionmakers in Europe. Or is EPA referring to a specific "RoHS" set of requirements set somewhere else?

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 is 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 a sticking point 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 would 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, NEMA recommends that the Tables be base on period designations of Wake, Leave, Return, and Sleep.

NEMA 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 (° 23.9C)

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 zero value for the customer. This may be a useful feature in the future when utilities begin to add thermostats to their HAN networks.As noted above, the standards for the Smart Grid are still undefined.

A key component that has impeded energy savings feedback has recently been overcome by the utilities. 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 90% of the country for the next 10 years will be costs that will never be recovered.

This is a future requirement and adding this feature to a thermostat adds significant cost to a thermostat while adding zero energy savings or value to the homeowner.

This feature should be removed and added to a future 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 in which to analyze this data. For example if a homeowner viewed o the thermostat that their furnace or air conditioner ran 400 minutes on Monday, 380 on Tuesday, 401 on Wednesday, 325 on Thursday etc. and my schedule was the same for each day, what is gained from such a feature?

This feature should be rewritten to provide a feature that helps the customer manage their energy usage. For example: month over month energy use, or year over year energy usage. There should be VOC (Voice of the Customer) research done here 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.*

Why is 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 used for utility systems demand response programs. This is short sighted 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 for 12 months. An 18-month battery life is "feature-creep" 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.

Thank you for your consideration of our comments. We hope and expect our suggested changes will be incorporated into Draft 2 of Version 2.0 to ensure that products to be qualified under the final Version 2.0 will be a genuine option for most U.S. residential energy consumers seeking to better manage and reduce their energy consumption while achieving a consistently comfortable climate inside their homes.

Questions about these comments should be directed to Craig Updyke of NEMA at 703 841 3294 or cra_updyke@nema.org.