PROPOSED REVISION TO JA5

Appendix JA5 – Technical Specifications for Occupant Controlled Smart Thermostats

2016 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS

November 24, 2014

1. INTRODUCTION

This document presents the proposed revisions to Title 24 Joint Appendix 5 – Technical Specifications for Occupant Controlled Smart Thermostats (JA5) that Sacramento Municipal Utility District (SMUD), Pacific Gas and Electric Company (PG&E), and Southern California Edison (SCE) are recommending.

The utilities that are recommending these changes, collectively referred to herein as the Utility Team, represent some of the largest utilities in California, serving over 30 million customers. As energy companies, we understand the important role that demand response (DR) plays in effective grid management. We have a responsibility to our customers to advocate for standards that maximize the benefits to our customers and the state as a whole.

This document presents why the Utility Team is recommending revisions to JA5 to improve clarity, how the recommended modifications were developed, and provides a justification for each change. This document also provides the marked-up code language.

We appreciate this opportunity to provide recommendations. We thank the California Energy Commission (CEC) for the opportunity to be involved in this process and encourage the CEC to carefully consider the recommendations outlined in this document.

2. CODE CHANGE PROPOSAL

2.1 Recommendation

The Utility Team has developed proposed revisions to JA5 to improve clarity. We are requesting that the CEC incorporate the proposed changes to JA5 that are presented in this document before the release of 45-day language.

2.2 Justification for Proposed Revisions to JA5

JA5 includes the technical specifications to which OCSTs must adhere to be in compliance with Title 24 Standards. The technical specifications in JA5 should provide the appropriate guidance to thermostat manufacturers to ensure that Title 24-compliant OCSTs that are installed during initial construction are capable of receiving a demand response signal and carrying out the appropriate control strategy within the building after receiving that signal. The revisions that were made to Joint Appendix 5 during the 2013 code cycle improved the OCST communications specifications. However, language regarding physical and logical communication is still ambiguous and some terms are not well defined. This ambiguity could leading to confusion and challenges with code compliance. The Utility Team is recommending further improvements to JA5 to improve clarity. The revisions to JA5 will have the following benefits:

- **Improve Interoperability:** The Utility Team supports efforts to establish code requirements that are based on open, non-proprietary, technologies. A successful DR event often requires communication between the customer, the utility, third-party signalers, and/or DR aggregators. Using open, non-proprietary, technology and

communications protocols can simplify the process of information and data exchanges that must occur for DR to be successful. That is, using open communication protocols can improve interoperability. As written, the revised JA5 specifications would allow a signaler to communicate directly with an OCST within a building. This will provide confidence that a Title 24-compliant OCST can communicate with utilities and can be used as part of a customer's DR response strategy.

- **Reduce Barriers to Participating in DR Events:** Title 24 requirements ensure that buildings are equipped with the necessary technology so customers are capable of participating in demand response events if they choose to do so. Clarifying the OCST communication requirements can provide assurance that OCSTs will be capable of communication with the DR signaler, thereby reducing barriers to participation in DR events and better positioning customers to take advantage of utility programs that could result in lower energy bills.
- **Improve Compliance:** Improving clarity regarding the definitions and requirements will make it easier for OCST manufacturers and code officials to understand the requirements and will lead to improved compliance.

2.3 Existing Standards

The 2013 Title 24 Standards include a mandatory requirement that nonresidential buildings with unitary, single zone heating and cooling systems be equipped with OCSTs if the building is not controlled by an energy management control system (EMCS). For residential buildings, applicants have the option of installing more efficient lighting and OCSTs instead of implementing the solar-ready provisions. JA5 includes the technical specifications for OCSTs used or both residential and nonresidential applications.

The proposed changes presented in this document modify language in JA5. The Utility Team is not proposing changes to when OCSTs are required or any other requirements other than those included in JA5.

2.4 Proposal Development Process

The Utility Team began efforts to develop clarified language for JA5 in the Summer of 2014. The Utility Team held internal meetings to classify challenges with the OCST from a program implementation perspective, to determine the Utility Team's goals in proposing revisions to JA5, to identify the highest priority revisions to propose during the 2016 code cycle, and to develop marked-up code language. During this initial stage, the Utility Team conducted targeted outreach to key stakeholders.

The Utility Team hosted a public stakeholder webinar on October 7, 2014 to discuss the proposed revisions with a wider stakeholder group. Over 300 stakeholders were invited including representatives from industry research groups, equipment and control system manufacturers, nonprofit organizations, builders, building officials and independent research laboratories. During the webinar the Utility Team presented the proposed revisions and made the draft language available for public review. The Utility Team requested that stakeholders provide feedback on the proposed revisions. Materials from the October 7, 2015 webinar (agenda, presentation, notes, and draft language) are available on Title24Stakeholders.com.

The Utility Team made adjustments to the proposed language based on feedback received during the public webinar and communications with stakeholders after the meeting. The Utility Team submitted draft language to CEC prior the Pre-rulemaking workshop that CEC held on November 3, 2014. The draft language is posted on the CEC website here: http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-06-12_workshop/final_case_reports/2016_Title_24_Proposed_Revisions_to_JA5_2014-10-17.pdf. CEC staff spoke about proposed revisions to JA5 during their presentation during for the November 3, 2014 workshop, but the proposed changes were not included in the draft standards that CEC released prior to the workshop.

2.5 Summary of Code Change Proposal

The proposed revisions will clarify the requirements in JA5. There are no recommended changes to the requirements in the main body of the Standards, and the revisions to JA5 are intended to be minimal. The specific revisions to JA5 are described below:

General Clean-up: Generally speaking, the language in JA5 was difficult to understand. The Utility Team offered revisions to sections of JA5 to help improve clarity and readability without modifying the requirements.

Clarify Definitions Communications Interfaces: Definitions for physical and logical communication interfaces were not clear. The proposed revisions aim to more clearly define the physical and logical interfaces. The physical communication interface is the physical connection that enables receipt of signals. The logical communication interface is the information model and its messaging protocol used for representation and interpretation of signals received by the OCST.

Clarify Requirements for Physical Communication: The requirements for the physical communication interface were ambiguous. The proposed revisions clarify that OCSTs shall be capable of connecting to either a Wi-Fi network and/or a Zigbee network. Manufacturers may choose to include additional physical communication interfaces, but at a minimum the OCST must be capable of communicating via Wi-Fi or Zigbee. The revised language also clarifies that the physical communication interface shall be capable of both receiving and sending information. This clarification is necessary because if a customer actually wants to sign up for a DR program, bi-directional communication is necessary. The customer needs to be capable of receiving a signal so demand shed is initiated. To manage the demand response event appropriately, the utility (or other entity sending the signal) needs to receive information from the customer so they can verify that the signal was received and if/how the customer is responding to the signal.

Clarify Logical Communication Requirements: The requirements for the logical communication interface were ambiguous. The proposed revisions clarify that OCSTs must be compliant with either OpenADR 2.0[1] or Smart Energy Profile (SEP) 1.1[2]. Both of these standards are open-based standards that are listed on the Smart Grid Interoperability Panel

[1] http://www.openadr.org/

[2] http://www.zigbee.org/Standards/ZigBeeSmartEnergy/Overview.aspx

(SGIP) Catalog of Standards (CoS).[3] Manufacturers may choose to use an additional communication protocol, but at a minimum the OCSTs must be compliant with either OpenADR2.0 or SEP 1.1. The proposed language also clarifies that applicants should check with the local utility for guidance on which logical communication protocol OCSTs in their service territory should use.

Clarify Requirements for Thermostats using Expansion Ports: The proposed language clarifies that if the OCST uses an expansion port, at the time of permitting the expansion port must be populated with the removable communication module. That is, at time of permitting, the OCST must be capable of the required communications. If desired, the building occupant can remove the communication module from the OCSTs after the certificate of occupancy is issued. The existing language could have been interpreted that if the OCST used an expansion port, the OCST did not have to be installed with the required communications capabilities. The revised language eliminates this loophole.

Clarify Requirements for Demand Responsive Control: The intention of the Standards is that OCSTs be a Demand Responsive Control that is capable of initiating a response to any Demand Response Signal for the appropriate Demand Response Period. The existing language in JA5 could have been interpreted that an OCST only needed to be responsive to price signals. The proposed language clarifies the original intent of the standards, and further clarifies that a price signal is a type of Demand Response Signal. Joint Appendix 1: Glossary includes the following definitions of Demand Response Period, Demand Response Signal, and Demand Responsive Control:

> **DEMAND RESPONSE PERIOD** is a period of time during which electricity loads are modified in response to a demand response signal.
>
> **DEMAND RESPONSE SIGNAL** is a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.
>
> **DEMAND RESPONSIVE CONTROL** is a kind of control that is capable of receiving and automatically responding to a demand response signal.

Eliminate Requirements for Demand Response Event Delay: Existing language states that if the logical communication protocol does not contain restoration delay logic, the OCST itself must have the capability of randomizing event restoration. This requirement is not precise and leaves significant work for the code enforcement body to determine if an OCST is in compliance. The Utility Team is recommending that requirements for event restoration delay be deleted. Ultimately, the utility, or the entity responsible for grid operation, is accountable for ensuring loads are come back online after an event. OpenADR 2.0a, OpenADR 2.0b and SEP 1.1 have a mandatory requirement to accommodate event restoration delay signals, but guidance on *how* the delay will occur come from the utility, or entity responsible for the grid operation. The Utility Team prefers that event restoration responsibilities fall with the utility not the OCST itself.

[3] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPCoSStandardsInformationLibrary

Add Requirements for Default Restart Settings and Automatic Rejoin: This Utility Team recommends adding requirements that ensure the OCST restores correctly after it loses power, restarts, or loses connection to the signaler. The default restart settings requirement states that if the OCST loses power or re-starts that when the device comes back online the device shall restore to the most recently programmed settings. The automatic rejoin requirements state that if physical and/or logical communication is lost, the OCST will trigger an automatic rejoin function to restore the communication connection.

3. DRAFT CODE LANGUAGE

The Utility Team's proposed revisions to JA 5 are provided on the following pages. All revisions are marked in red text. Additions to the existing code language are underlined. Deletions to existing text are ~~struck.~~

Joint Appendix JA5

Appendix JA5 - Technical Specifications For Occupant Controlled Smart Thermostats

Table of Contents

JA5.1 Introduction

The Occupant Controlled Smart Thermostat (OCST)[21] shall be self-certified by the manufacturer to the Energy Commission to meet the requirements described in this section. This document provides a high level technical specification for an OCST. All OCSTs shall comply with the specifications set forth in this document or a specification approved by the Executive Director. This specification focuses on three interfaces that the Energy Commission has determined shall be supported by all OCSTs:

(a) Communications Interface

(b) User Display and Interface

(c) HVAC System Interface

Sections within this document address each interface in terms of its hardware and software characteristics. This specification is intended to compatible with National Electrical Manufacturers Association (NEMA) Standards Publication DC 3-2008– "Residential Controls – Electrical Wall-Mounted Thermostats"[32] unless otherwise specified.

The Communications Interface is comprised of the (1) physical communication interface and the (2) logical communication interface.

(a) The physical communication interface describes the physical connection that enables receipt of Demand Response signals or price signals.

(b) The logical communication interface describes the information model and its messaging protocol used for representation and interpretation of signals received by the OCST.

See Section 5.3.1 for a more detailed explanation of these communication interfaces.

~~defined as a set of logical services that may be performed over a physical network interface connected to either an expansion port or an internal communications device. The communications interface is designed to permit a variety of intended uses for OCSTs including remote energy management services, to the extent that occupants voluntarily enable such services. To the extent possible, this document strives to be compatible with related efforts underway (e.g. National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel (SGIP), Open Smart Grid, etc.).~~

~~The following elements are addressed in this document:~~

~~(a) Support for the basic HVAC terminal interface specification~~

~~(b) Support for an internal communications device for an expansion port that will allow for the installation of a removable module to enable communications with the thermostat.~~

~~The following sections describe these and other elements of the specification in more detail.~~

---

1 A networked system of devices which is capable of receiving and responding to Demand Response Signals and provides equivalent functionality as required by Reference Joint Appendix JA5, shall be considered equivalent to an OCST.

2 NEMA DC 3-2008 - http://www.nema.org/Standards/Pages/Residential-Controls-Electrical-Wall-Mounted-Room-Thermostats.aspx

JA5.2 Required Functional Resources

JA5.2.1 Setback Capabilities

All OCSTs shall meet the requirements of Section 110.2(c). Thermostats for heat pumps shall also meet the requirements of Section 110.2(b).

JA5.2.2 Communication Capabilities

OCSTs shall include communication capabilities compliant with section 5.3.1 and be enabled through either:

(a) At least one expansion port ~~which will allow for the installation of~~ with a removable module containing a radio ~~or physical connection port~~ to enable communication; or

(b) Onboard communication device(s)

See Sections 5.3.2 and 5.3.3 for a more detailed description of expansion port and onboard communication device, respectively.

JA5.2.3 OCST Messages and Attributes

The OCST communications capabilities shall enable Demand Responsive Control through receipt of Demand Response Signals or price signals. After OCST communication is enabled and the occupant has enrolled in a Demand Response program or subscribed to receive demand response or pricing related messages or information updates, the OCST shall be capable of both receiving and responding to Demand Response Signals. The OCST with communications enabled recognizes two basic system event modes: price response and Demand Response Periods. Both basic system event modes can be overridden by the occupant.

JA5.2.3.1 Demand Responsive Control ~~Price Signals~~

The OCST shall be capable of Demand Responsive Control for the Demand Response Period upon receipt of a Demand Response Signal, which is a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period. A price signal is a type of Demand Response signal.

Price signals allow the utility or another entity selected by the occupant to send a signal or message to the occupant's OCST to provide pricing information to the occupant and initiate Demand Responsive Control for the Demand Response Period utilizing a Demand Response Signal.

Price signal attributes and requirements shall be specified within the messaging protocol utilized by the utility or other entity selected by the occupant.

JA5.2.3.2 Demand Response Periods

This event class allows the utility or another entity selected by the occupant to initiate Demand Responsive Control for the Demand Response Period utilizing a Demand Response Signal.

Demand Response Signal attributes and requirements shall be specified within the messaging protocol utilized by the utility or other entity selected by the occupant.

If a price signal or Demand Response Signal is received and validated, but conflicts with a prior message, the newer message shall supersede the previous message and any continuing action for the prior message is automatically terminated by the OCST (unless the subsequent message attempts to initiate an action that has been disapproved by the occupant).

JA5.2.4 Event Response

Event response, unless overridden by the occupant or modified by an energy management control system or service, may be triggered by price signals or Demand Response Signals. The OCST shall provide one set of event responses for price signals and one set of event responses for Demand Response Signals. The responses may be common for both types of events.

OCSTs~~, with communications enabled,~~ shall be capable of receiving and automatically responding to the Demand Response Signals as follows:

(a) A Demand Response Signal shall trigger the OCST to adjust the thermostat setpoint by either the default number of degrees or the number of degrees established by the occupant.

(b) When a price signal indicates a price in excess of a price threshold established by the occupant, the OCST shall adjust the thermostat setpoint by either the default number of degrees or the number of degrees established by the occupant.

(c) In response to price signals or Demand Response signals, the OCST shall default to an event response that initiates setpoint offsets of +4°F for cooling and -4°F for heating relative to the current setpoint.

(d) The OCST shall have the capability to allow occupants or their representative to modify the default event response with occupant defined event responses for cooling and heating relative to the current setpoint in response to price signals or Demand Response Signals.

(e) Override Function: Occupants shall be able to change the event responses and thermostat settings or setpoints at any time, including during price events or Demand Response Periods.

(f) The Demand Response Signal shall start the Demand Response Period either immediately or at a specific start time as specified in the event signal and continue for the Demand Response Period specified in the Demand Response Signal or until the occupant overrides the event setpoint.

(g) The thermostat's price response shall start either immediately or at a specific start time as specified in the pricing signal and continue for the duration specified in the pricing signal or until the occupant overrides the event setpoint.

(h) The OCST shall have the capability to allow occupants to define setpoints for cooling and heating in response to price signals or Demand Response signals as an alternative to the default event response.

(i) At the end of a price event or Demand Response Period, the thermostat setpoint shall be set to the setpoint that is programmed for the point in time that the event ends or to the manually established setpoint that existed just prior to the Demand Response Period.

JA5.2.5 Other Required Capabilities

~~(a) Demand Response Event Restoration Delay: Unless the messaging protocol contains randomization or restoration delay logic, OCSTs shall provide a mechanism, such as a randomized delay, to prevent all of the OCSTs within a demand-response area from ending the demand-response event at the same time. This mechanism can be implemented within the control logic of the OCST, within the control logic of the demand-response signaling system, or within the control logic of the communication network between the OCST and the demand-response signaling system. The display of the thermostat shall accurately indicate the end of the event, accounting for any delays or advances provided by this mechanism. The specific maximum restoration delay for restoration after a Demand Response Period shall be 30 minutes or alternatively can be defined within the Demand Response Signal for that event.~~

(a) Default Restart Settings: In the event of a disruption of power to the device that results in power-off or restart, upon device restart, the device shall automatically restore the most recently programmed settings, including reconnection to a network, if the device was previously enabled and network connectivity is available.

(b) Automatic Rejoin: OCST's are expected to connect, and remain connected in its communication path and control end point. The OCST shall incorporate an automatic rejoin function. When physical and/ or logical communication is lost, the OCST shall trigger its automatic rejoin function to restore the physical and/or logical communication connection.

JA5.3 Functional Descriptions

JA5.3.1 Communication Interface

The communications interface has two aspects – the physical interface and the logical interface.

The physical communications interface describes the physical connection through which event signals are received, and shall meet the following requirements:

1. The OCST shall be capable of connecting to a Wi-Fi network compliant with Institute of Electrical and Electronics Engineers (IEEE) Standard 802.11, and/or a Zigbee network compliant with IEEE 802.15.4. Manufacturers may choose to include additional wireless or wired physical communication interfaces.

2. The physical communication interface shall be capable of bi-directional exchange of information over its communication path.

The logical communication interface within the OCST hardware, which describes the messaging protocol and information model used in representation and interpretation of demand response signals, shall comply at minimum, with any individual or combination of the following open-based standards: OpenADR 2.0[3] or Smart Energy Profile (SEP) 1.1[4] which are listed in the

[3] http://www.openadr.org/
[4] http://www.zigbee.org/Standards/ZigBeeSmartEnergy/Overview.aspx

Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS)[5]. Manufacturers may choose to provide additional logical communication protocols. Builders, HVAC installers, architects, and all other Title 24 professionals should check with the local utility (where the property is located) on guidance when choosing the DR signal standard for the OCST.

Using receipt of a demand response signal via the physical communication interface, and interpretation of the signal via the logical communication interface, the OCST shall be capable of automatically initiating demand responsive control.

~~The physical communications interface includes a one-or two-way communications interface as selected and specified by the occupant's utility, information update service or Demand Response service provider and enabled by either onboard communications devices or a communications module in the case of an expansion/communication port. There is no mandated specification for the physical communications protocol. However, the communications capabilities shall enable Demand Responsive Control through receipt of Demand Response Signals based on communications standards (including but not limited to ZigBee (IEEE 802.15.4) or WiFi (IEEE 802.11)).~~

~~The logical interface consists of the information model used to represent messages sent to the OCST. There is no mandated specification for the logical interface , but direction is provided as "standards based messaging protocols (including but not limited to Smart Energy Profile (SEP), OpenADR or others defined in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS))" or as defined by the occupant's information update service or Demand Response service provider.~~

JA5.3.2 Expansion~~/Communication~~ Port

The expansion port allows for the installation of a removable module to enable physical and logical communication as described in Section 5.3.1. ~~This port is available to be used by a module supporting one-way or two-way communications~~ using standards-based communication ~~protocols as described in Section 5.3.1. The module shall also enable standards based messaging protocols (including but not limited to Smart Energy Profile (SEP), OpenADR or others defined in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS)) or as defined by the occupant's information update service or Demand Response service provider.~~

When the Expansion~~/Communication~~ port is unpopulated, the thermostat shall function as a programmable setback thermostat and shall meet the requirements of Sections 110.2(b) and (c).

The removable module may also provide a means of memory storage, logging, and firmware upgrade. The requirements associated with the expansion port ~~interface~~ are:

(a) The expansion~~/communication~~ port shall be readily accessible to the occupant for installing and removing the communication module.

(b) Installation of the module shall upgrade the programmable setback thermostat to an OCST.

[5] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPCoSStandardsInformationLibrary

(c) After communications are enabled[6] and the occupant has enrolled in a Demand Response program or subscribed to receive demand response related messages or information updates, the OCST shall be capable of both receiving and responding to Demand Response Signals.

The ~~OCST's~~ expansion port ~~interface~~ has no mandated configuration or design specification.

JA5.3.3 Onboard Communication Devices

When onboard communication devices are present, the thermostat or HVAC control system shall be equipped with the capability to enable or disable the onboard communication device(s). The switch or interface to enable or disable onboard communications shall be readily accessible to the occupant.

When onboard communications are disabled, the thermostat shall function as a programmable setback thermostat and shall meet the requirements of Section 110.2(c). Thermostats for heat pumps shall also meet the requirements of Section 110.2(b).

JA5.3.4 User Display & Interface

The OCST shall have the capability to display information to the user. The following information shall be readily available whenever the OCST display is active:

(a) Communications system connection status,

(b) An indication that a Demand Response Period or pricing event is in progress,

(c) Other maintenance-related information,

(d) The currently sensed temperature,

(e) The current setpoint.

JA5.3.5 Required Functional Behavior

(a) Clock Operation. The clock mechanism enables the OCST to execute temperature setpoints scheduled by the occupant. It also supports other timing functions such as start-time, end-time and duration for coordination of Demand Response Periods and price signal response. The OCST shall provide a pair of programmable thermostat setpoint time and temperature parameters for at least four operating periods that collectively govern thermostat operation during the 24-hour day.

Accuracy to a precision of one minute is acceptable for this operating environment and the applications being considered.

The clock in an OCST may be set by the occupant, using the OCST's human-machine interface. Alternatively, an OCST with communications enabled may be set or synchronized by the occupant's selected service provider.

[6] The removable module, or gateway for a networked system of devices, for enabling communications can be selected and installed at the time of enrollment in a Demand Response program or subscription to receive demand response related messages or information updates.

(b) Normal Operation. Normal operation of an OCST is defined to be the OCST's prevailing mode of operation as determined by the occupant's prior settings and use of features[7] provided by the OCST manufacturer's design. Aspects of normal operation of an OCST may be modified or interrupted in response to occupant subscribed price signals or when Demand Response Periods are in progress, but only to the extent specified by occupants or their representatives.

Unless an occupant has elected to connect the OCST to an energy management control system or service that provides for alternate strategies, the OCST shall provide a mode of operation whereby it controls temperature by following the scheduled temperature setpoints.

Occupants shall always have the ability to change OCST settings or use other features of an OCST during an event. Those changes may alter what is considered to be the prevailing mode of operation when a Demand Response Period is terminated and the OCST returns to normal operation.

(c) Demand Responsive Control. Upon receiving a price signal or a Demand Response Signal, OCSTs shall be capable of automatic event response by adjusting the currently applicable temperature setpoint by the number of degrees indicated in the temperature offset (heating or cooling, as appropriate).

Override: OCSTs shall allow an occupant or their representative to alter or eliminate the default response to price signals or Demand Response Signals, and to override any individual price response or Demand Responsive Control and allow the occupant to choose any temperature setpoint at any time including during a price event or a Demand Response Period.

When the price signal changes to a non-response level or the Demand Response Period is concluded, OCSTs shall return to normal operation. The thermostat setpoint shall be set to the setpoint that is programmed for the point in time that the event ends or to the manually established setpoint that existed just prior to the Demand Response Period.

The OCST shall also be equipped with the capability to allow occupants to define setpoints for cooling and heating in response to price signals or Demand Response Signals as an alternative to the default event response. The default setpoint definitions unless redefined by the occupant shall be as follows:

1. The default price response or Demand Response Period setpoint in the cooling mode for OCSTs shall be 82°F. The OCST shall allow the occupant to change the default event setpoint to any other value.

2. The default price response or Demand Response Period setpoint in the heating mode for OCSTs shall be 60°F. The OCST shall allow the occupant to change the default event setpoint to any other value.

3. The OCST shall ignore price response or Demand Response Period setpoints that are lower (in cooling mode) or higher (in heating mode) than the programmed or occupant selected prevailing setpoint temperature upon initiation of the price event or Demand Response Period.

[7] The specific design of such features (e.g. HOLD, OVERRIDE) is defined by individual manufacturers and not by this document.

4. By default, thermostats shall not be remotely set above 90°F or below 50°F. Occupants shall have the ability to redefine these limits. This measure protects occupant premises from extreme temperatures that might otherwise be imposed by event responses, should the occupant already have a very high or low temperature setpoint in effect.

The occupant may still override or change the setpoint during all price events and Demand Response Periods. Price signal response and Demand Responsive Control only modify the operating range of the thermostat. They do not otherwise affect the operation and use of features provided by the manufacturer's design.

JA5.3.6 Restoring Factory Installed Default Settings

The OCST shall include the capability to allow the occupant to restore the factory installed default settings.

JA5.3.7 Security

Demand Response Signal security attributes and requirements shall be specified within both the communications standard and the messaging protocol utilized by the utility or other entity selected by the occupant. The OCST communication system shall consider relevant security issues and potential cyber-attacks[8].

JA5.4 The HVAC System Interface

HVAC wiring terminal designations shall be clearly labeled. OCSTs shall use labels that comply with Table 5-1 in NEMA DC 3-2008. It is noted that OCSTs using wired or wireless digital data interfaces do not directly follow NEMA DC 3-2008

JA5.5 Terminology

Current Setpoint The setpoint that existed just prior to the price event or Demand Response Period.

Demand Response See Joint Appendix JA1- Glossary.

Demand Response Period See Joint Appendix JA1- Glossary.

Demand Response Signal See Joint Appendix JA1- Glossary.

Demand Response Control See Joint Appendix JA1- Glossary.

[8] A thorough discussion of security issues may be found at: http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/CyberSecurityCTG

Energy Management Control System	See Joint Appendix JA1- Glossary.
Override	Refers to an occupant adjusting thermostat settings to either not respond to a Demand Response Signal or adjusting the setpoint compared to the OCST's programmed response to a price signal or Demand Response Signal.
~~**Price Signal**~~	~~is a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider, information update service or aggregator, to an enrolled or subscribed customer, indicating a price or other economic indicator that can trigger OCST Demand Responsive Control.~~
Price Event	Refers to a change in pricing sent to the OCST from the utility or the occupant's selected demand response provider.