

Demand Response Clean Up

Draft Code Language

Last Updated: March 27, 2017

1. INTRODUCTION

The California Statewide Utility Codes and Standards Team actively supports the California Energy Commission in developing revisions to the 2019 California Building Energy Efficiency Standards (Title 24, Part 6). Our joint intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code change proposals for the 2019 Title 24 code change cycle.

The Statewide Utility Team is proposing code change for the Demand Response (DR) Clean-up measure. The objectives of this code change proposal are to clean up and clarify the existing DR requirements so all sections of the standards use consistent terminology and approach. The goals are to improve comprehension of and compliance with the requirements and to make it easier for occupants of compliant buildings to realize the economic benefits of their buildings' DR capabilities by enrolling in DR programs.

The Statewide Utility Team will recommend improvements to the language in the Standards, the Appendices to the Standards, and the Compliance Manuals to:

1. Improve and clarity of the code language without changing the stringency of the Standards;
2. Harmonize the demand responsive control requirements, including requirement related to the application of open or standards-based communications protocols;
3. Clarify and improve the compliance and enforcement process;
4. Establish a foundation within the Standards, Appendices, Alternative Calculation Method Reference Manuals, and Compliance Manuals upon which additional measures that have benefits pertaining to load reshaping and ancillary services can be added in future code cycles.

The modifications aim to align the terminology used in Title 24, Part 6 with modern terminology used by industry, utility programs, and other regulating bodies. Revisions also aim to provide sufficient detail on how to comply with the Standards while maintaining the appropriate level of leeway to allow for continued market innovation and transformation.

The Statewide Utility Team is requesting feedback on the draft code language presented in this document. Input we receive will inform the code change proposal that the Statewide Utility Team will be proposing to the California Energy Commission in April 2017. To provide feedback, please email us at info@title24stakeholders.com or contact the measure leads whose contact information is provided below:

Bijit Kundu
Energy Solutions
bkundu@energy-solution.com
(510) 482-4420 ext. 261

Heidi Hauenstein
Energy Solutions
hhauenstein@energy-solution.com
(510) 482-4420 ext. 219

For more information about the California Statewide Utility Codes and Standards Team's 2019 Title 24, Part 6 advocacy efforts, and the latest information on this code change proposal please visit: www.title24stakeholders.com.

2. DRAFT CODE LANGUAGE

The proposed changes to the Standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2016 documents are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

2.1 Standards

10-103 – PERMIT, CERTIFICATE, INFORMATIONAL, AND ENFORCEMENT REQUIREMENTS FOR DESIGNERS, INSTALLERS, BUILDERS, MANUFACTURERS, AND SUPPLIERS

(b) **Compliance, Operating, Maintenance, and Ventilation Information to be provided by Builder.**

1. Compliance information.

- A. For low-rise residential buildings, at final inspection, the enforcement agency shall require the builder to leave in the building, copies of the completed, signed, and submitted compliance documents for the building owner at occupancy. For low-rise residential buildings, such information shall, at a minimum, include copies of all Certificate of Compliance, Certificate of Installation, and Certificate of Verification documentation submitted. These documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).
- B. For nonresidential buildings, high-rise residential buildings and hotels and motels, at final inspection, the enforcement agency shall require the builder to leave in the building, copies of the completed, signed, and submitted compliance documents for the building owner at occupancy. For nonresidential buildings, high-rise residential buildings and hotels and motels, such information shall include copies of all Certificate of Compliance, Certificate of Installation, Certificate of Acceptance and Certificate of Verification documentation submitted. These documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).

2. **Operating information.** At final inspection, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, operating information for all applicable features, materials, components, ~~and~~ mechanical devices, and building control systems (including Demand Responsive controls) installed in the building. Operating information shall include instructions on how to operate the features, materials, components, ~~and~~ mechanical devices, and building control systems correctly and efficiently. The instructions shall be consistent with specifications set forth by the Executive Director. For low-rise residential buildings, such information shall be contained in a folder or manual which provides all information specified in Section 10-103(b). This operating information shall be in paper or electronic format.

For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building. This operating information shall be in paper or electronic format.

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

AUTOMATIC CONTROL SYSTEM is a device or system capable of automatically turning loads off and on without manual intervention.

DEMAND RESPONSE is short-term changes in electricity usage by end-use customers from their normal consumption patterns. Demand response may be in response to:

- a. changes in the price of electricity; or
- b. participation in programs or services designed to modify electricity use
 - i. in response to wholesale market prices, or
 - ii. when system reliability is jeopardized.

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 ~~an automatic control system~~ ~~a kind of control~~ that is capable of receiving ~~and automatically responding to a Demand Response Signal~~ ~~and automatically initiating a control strategy when a Demand Response Signal is received.~~

ENERGY MANAGEMENT CONTROL SYSTEM (EMCS) is a ~~computerized Automatic Control System designed to that~~ regulates the energy consumption of a building by controlling the operation of energy consuming systems, ~~such as the heating, ventilation and air conditioning (HVAC), lighting, and water heating systems, and An EMCS is capable of Demand Responsive Control and~~ of monitoring environmental and system loads, and adjusting ~~HVAC building system operations in order~~ to optimize energy usage ~~and respond to demand response signals.~~

HOME AUTOMATION SYSTEM: *definition will be added*

THERMOSTAT is an automatic control device ~~or system~~ used to maintain temperature at a fixed or adjustable setpoint.

THERMOSTATIC CONTROL is an automatic device or system used to maintain temperature at a fixed or adjustable setpoint.

SECTION 110.2 – MANDATORY REQUIREMENTS FOR SPACE- CONDITIONING EQUIPMENT

- (b) **Controls for Heat Pumps with Supplementary Electric Resistance Heaters.** Heat pumps with supplementary electric resistance heaters shall have controls:
1. That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and
 2. In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

EXCEPTION 1 to Section 110.2(b): The controls may allow supplementary heater operation during:

- A. Defrost; and
- B. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

EXCEPTION 2 to Section 110.2(b): Room air-conditioner heat pumps.

(c) **Thermostatic controls.**

1. ~~All~~ Unitary heating or cooling systems not controlled by a central energy management control system (EMCS) shall have ~~thermostatic controls with a setback thermostat.~~ **Setback Capabilities.** ~~All thermostats shall have~~ a clock mechanism that allows the building occupant to ~~P~~rogram the temperature setpoints for at least four periods within 24 hours.
2. ~~Thermostats for h~~Heat pump systems shall ~~have thermostatic controls that~~ meet the requirements of Section 110.2(b).

EXCEPTION to Section 110.2(c): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, noncentral electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air-conditioner heat pumps.

SECTION 110.10 – MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS

(a) **Solar Zone.**

1. **Minimum Area.** The solar zone shall have a minimum total area as described below. The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area shall be comprised of areas that have no dimension less than five feet and are no less than 80 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet.

- A. **Single Family Residences.** The solar zone shall be located on the roof or overhang of the building and have a total area no less than 250 square feet.

EXCEPTION 1 to Section 110.10(b)1A: Single family residences with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than 1000 watts.

EXCEPTION 2 to Section 110.10(b)1A: Single family residences with a permanently installed domestic solar water-heating system meeting the installation criteria specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50.

EXCEPTION 3 to Section 110.10(b)1A: Single family residences with three habitable stories or more and with a total floor area less than or equal to 2000 square feet and having a solar zone total area no less than 150 square feet.

EXCEPTION 4 to Section 110.10(b)1A: Single family residences located in Climate zones 8-14 and the Wildland-Urban Interface Fire Area as defined in Title 24, Part 2 and having a whole house fan and having a solar zone total area no less than 150 square feet.

EXCEPTION 5 to Section 110.10(b)1A: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 110 degrees and 270 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

EXCEPTION 6 to Section 110.10(b)1A: Single family residences ~~having a solar zone total area no less than 150 square feet and~~ where all thermostats comply with Reference Joint Appendix JA5 and ~~are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.~~

~~**EXCEPTION 7 to Section 110.10(b)1A:** Single family residences meeting the following conditions:~~

~~All thermostats comply with Reference Joint Appendix JA5 and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency. C~~ comply with one of the following measures:

- A. Have a solar zone with total area no less than 150 square feet; or
 - B. Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements with either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or
 - C. Install a home automation system capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or
 - D. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the *California Plumbing Code* and any applicable local ordinances; or
 - E. Install a rainwater catchment system designed to comply with the *California Plumbing Code* and any applicable local ordinances, and that uses rainwater flowing from at least 65 percent of the available roof area.
- B. Low-rise and High-rise Multi-family Buildings, Hotel/Motel Occupancies, and Nonresidential Buildings.** The solar zone shall be located on the roof or overhang of the building or on the roof or overhang of another structure located within 250 feet of the building or on covered parking installed with the building project and have a total area no less than 15 percent of the total roof area of the building excluding any skylight area.

EXCEPTION 1 to Section 110.10(b)1B: Buildings with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than one watt per square foot of roof area.

EXCEPTION 2 to Section 110.10(b)1B: Buildings with a permanently installed domestic solar water- heating system complying with Section 150.1(c)8Ciii.

EXCEPTION 3 to Section 110.10(b)1B: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 110 degrees and 270 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

EXCEPTION 4 to Section 110.10(b)1B: Low-rise and high-rise multifamily buildings meeting the following conditions:

- A. All thermostats in each dwelling unit comply with Reference Joint Appendix JA5 ~~and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.~~
- B. In each dwelling unit, comply with one of the following measures:
 - i. Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements with either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or
 - ii. Install a home automation system capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or
 - iii. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the *California Plumbing Code* and any applicable local ordinances; or
 - iv. Install a rainwater catchment system designed to comply with the *California Plumbing Code* and any applicable local ordinances, and that uses rainwater flowing from at least

65 percent of the available roof area.

EXCEPTION 5 to Section 110.10(b)1B: Buildings where the roof is designed and approved to be used for vehicular traffic or parking or for a heliport.

SECTION 110.X – REQUIRED AUTOMATIC DEMAND RESPONSIVE CONTROL

(a) **Automatic Demand Responsive Controls.** All Demand Responsive Controls shall be capable of:

- A. Receiving a Demand Response Signal from at least one standards-based messaging protocol.
- B. Automatically initiating the control strategy defined in Section 110.x(b) through Section 110.x(d) upon receiving a Demand Responses Signal.
- C. Manual override.

(b) **Automatic Demand Responsive Indoor Lighting Control Strategy.** Buildings larger than 10,000 square feet shall have Demand Responsive Controls that meet the requirements of Section 110.x(a) and, upon receiving a Demand Responses Signal, are capable of automatically reduce lighting by a minimum of 15 percent below the total installed lighting power for the duration of the Demand Response Period. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A.

EXCEPTION 1 to Section 110.x(b): Spaces within buildings over 10,000 square feet with a lighting power density of 0.5 watts per square foot or less.

EXCEPTION to Section 110.x(b): Lighting not permitted by a health or life safety statute, ordinance, or regulation to be reduced shall not be counted toward the total lighting power.

(c) **Automatic Demand Responsive Sign Lighting Control Strategy.** Electronic Message Center (EMC)s having a new connected lighting power load greater than 15 kW shall have Demand Responsive Controls that meet the requirements of Section 110.x(a) and, upon receiving a Demand Responsive Signal, are capable of automatically reducing the lighting power by a minimum of 30 percent for the duration of the Demand Response Period.

EXCEPTION to Section 110.x(b): Lighting for EMCs that is not permitted by a health or life safety statute, ordinance, or regulation to be reduced by 30 percent.

(d) **Automatic Demand Responsive HVAC Control Strategy.**

1. HVAC systems with DDC to the Zone level shall have Demand Responsive Controls that meet the requirements of Section 110.x(a) and are capable of automatically implement the following control strategy:

- A. Upon receiving a Demand Response Signal:
 - i. Adjust the operating cooling temperature set points up by 4 degrees or more in all Non-Critical Zones and maintain adjusted set points for the Demand Response Period.
 - ii. Adjust the operating heating temperature set points down by 4 degrees or more in all Non-Critical Zones and maintain adjusted set points for the Demand Response Period.

B. Upon conclusion of the Demand Response Period, reset the temperature set points in all Non-Critical Zones to the original set points.

C. Provide an adjustable rate of change for the temperature adjustments.

2. HVAC systems that use single zone air conditioners and heat pumps and do not have DDC to the Zone level shall have thermostatic controls that comply with the requirements of Section 110.2(c) and Reference Joint Appendix JA5.

EXCEPTION 1 to Section 110.x(d): Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants or animals.

EXCEPTION 2 to Section 110.x(d): Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps.

SECTION 110.XY – REQUIREMENTS FOR ENERGY MANGEMENT CONTROL SYSTEMS

This section needs additional work. Intend on clarifying minimum requirements for EMCSs, when EMCSs can be used to meet building control requirements, and the relationship between the EMCS and the “gateway” / “virtual end node”. May require adding definitions of “gateway” and “virtual end node” to Section 100.1

(a) Minimum Requirements for Energy Management Control System (EMCS).

1. Place holder will explore minimum requirements an EMCS

(b) Use of EMCS to Meet Lighting Controls Requirements

1. An EMCS may be used to comply with the requirements of one or more lighting controls if it meets the requirements of Section 110.y(a) and the following minimum requirements:
 - A. Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Section 110.9; and
 - B. Complies with all applicable Lighting Control Installation Requirements in accordance with Section 130.4 for each specific lighting control or system for which it is installed; and
 - C. Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.
2. An EMCS may be used to comply with dimmer requirements in Section 150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, meets the installation certificate requirements in Section 130.4, the EMCS requirements in Section 130.5(f), and complies with all other applicable requirements in Section 150.0(k)2.
3. An EMCS may be used to comply with vacancy sensor requirements in Section 150.0(k) if at a minimum it provides the functionality of a vacancy sensor in accordance with Section 110.9, meets the installation certificate requirements in Section 130.4, the EMCS requirements in Section 130.5(f), and complies with all other applicable requirements in Section 150.0(k)2.

(c) Use of EMCS to meet HVAC Control Requirements.

1. An EMCS may be used to comply with thermostatic control requirements specified in Section 120.2(a) if the EMCS complies with all applicable requirements in 120.2(b).

SECTION 120.2 – REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

- (a) **Thermostatic Controls for Each Zone.** The supply of heating and cooling energy to each space-conditioning zone or dwelling unit shall be controlled by ~~an individual~~ thermostatic controls that responds to temperature within the zone and that meets the applicable requirements of Section 120.2(b). Thermostatic controls must comply with the requirements in Section 110.x. An Energy Management Control System (EMCS) that complies with Section 110.y may be used installed to comply with the requirements of this section, one or more thermostatic controls if it complies with all applicable requirements for each thermostatic control.

EXCEPTION to Section 120.2(a): An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

1. All zones are also served by an interior cooling system;

2. The perimeter system is designed solely to offset envelope heat losses or gains;
3. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
4. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

(b) **Criteria for Zonal Thermostatic Controls.** The individual thermostatic controls required by Section 120.2(a) shall meet the following requirements as applicable:

1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.
3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items 1 and 2 and shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

EXCEPTION to Section 120.2(b)3: Systems with thermostats that require manual changeover between heating and cooling modes.

~~4. Thermostatic controls for all single zone air conditioners and heat pumps, shall comply with the requirements of Section 110.2(c) and Reference Joint Appendix JA5 or, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section 120.2(h).~~

~~**EXCEPTION 1 to Section 120.2(b)4:** Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants or animals.~~

~~**EXCEPTION 2 to Section 120.2(b)4:** Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air conditioner heat pumps.~~

(c) **Hotel/Motel Guest Room and High-rise Residential Dwelling Unit Thermostats.**

1. Hotel/motel guest room thermostats shall:
 - A. Have numeric temperature setpoints in °F and °C; and
 - B. Have setpoint stops, which are accessible only to authorized personnel, such that guest room occupants cannot adjust the setpoint more than ±5°F (±3°C); and
 - C. Meet the requirements of Section 150.0(i).

EXCEPTION to Section 120.2(c)1: Thermostats that are integrated into the room heating and cooling equipment.

2. High-rise residential dwelling unit thermostats shall meet the requirements of Section 150.0(i).

(d) **Heat Pump Controls.** All heat pumps with supplementary electric resistance heaters shall ~~be installed with~~ have controls that comply with Section 110.2(b).

(h) **Automatic Demand ~~Shed~~ Responsive Controls.** HVAC systems ~~with DDC to the Zone level~~ shall meet Demand Responsive Control Requirements in Section 110.x. ~~be programmed to allow centralized demand shed for non-critical zones as follows:~~

- ~~1. The controls shall have a capability to remotely setup the operating cooling temperature set points by 4 degrees or more in all non-critical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).~~
- ~~2. The controls shall have a capability to remotely set down the operating heating temperature set points by 4 degrees or more in all non-critical zones on signal from a centralized contact or software point within an EMCS.~~

3. ~~The controls shall have capabilities to remotely reset the temperatures in all non-critical zones to original operating levels on signal from a centralized contact or software point within an EMCS.~~
4. ~~The controls shall be programmed to provide an adjustable rate of change for the temperature setup and reset.~~
5. ~~The controls shall have the following features:~~
 - A. ~~Disabled. Disabled by authorized facility operators; and~~
 - B. ~~Manual control. Manual control by authorized facility operators to allow adjustment of heating and cooling set points globally from a single point in the EMCS; and~~
 - C. ~~Automatic Demand Shed Control. Upon receipt of a demand response signal, the space-conditioning systems shall conduct a centralized demand shed, as specified in Sections 120.2(h)1 and 120.2(h)2, for non-critical zones during the demand response period.~~

SECTION 130.0 – LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS —GENERAL

~~(d) **Energy Management Control System (EMCS).**~~

1. ~~An EMCS may be installed to comply with the requirements of one or more lighting controls if it meets the following minimum requirements:~~
 - A. ~~Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Section 110.9; and~~
 - B. ~~Complies with all applicable Lighting Control Installation Requirements in accordance with Section 130.4 for each specific lighting control or system for which it is installed; and~~
2. ~~130.4 for each specific lighting control or system for which it is installed; and~~
 - A. ~~Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.~~

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

~~(e) **Demand Responsive Controls.** Buildings larger than 10,000 square feet shall meet the meet Demand Responsive Control Requirements in Section 110.x~~

1. ~~Buildings larger than 10,000 square feet, excluding spaces with a lighting power density of 0.5 watts per square foot or less, shall be capable of automatically reducing lighting power in response to a Demand Response Signal; so that the total lighting power of non-excluded spaces can be lowered by a minimum of 15 percent below the total installed lighting power when a Demand Response Signal is received. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A.~~
2. ~~**EXCEPTION to Section 130.1(e):** Lighting not permitted by a health or life safety statute, ordinance, or regulation to be reduced shall not be counted toward the total lighting power.~~
3. ~~Demand responsive controls and equipment shall be capable of receiving and automatically responding to at least one standards-based messaging protocol by enabling demand response after receiving a demand response signal.~~

TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS

| Luminaire Type | Minimum Required Control Steps (percent of full rated power ¹) | Uniform level of illuminance shall be achieved by: |
|-----------------------------------|--|---|
| Line-voltage sockets except GU-24 | | |
| Low-voltage incandescent systems | | |

| | | | | |
|--|--|---------|---------|---|
| LED luminaires and LED source systems | Continuous dimming 10-100 percent | | | |
| GU-24 rated for LED | | | | |
| GU-24 sockets rated for fluorescent > 20 watts | Continuous dimming 20-100 percent | | | |
| Pin-based compact fluorescent > 20 watts ² | | | | |
| GU-24 sockets rated for fluorescent ≤ 20 watts | Minimum one step between 30-70 percent | | | Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire |
| Pin-based compact fluorescent ≤ 20 watts ² | | | | |
| Linear fluorescent and U-bent fluorescent ≤ 13 watts | | | | |
| Linear fluorescent and U-bent fluorescent > 13 watts | Minimum one step in each range: | | | |
| | 20-40 % | 50-70 % | 75-85 % | 100 % |
| Track Lighting | Minimum one step between 30 – 70 percent | | | Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits. |
| HID > 20 watts | Minimum one step between 50 - 70 percent | | | Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner. |
| Induction > 25 watts | | | | |
| Other light sources | | | | |
| 1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor 2. Includes only pin based lamps: twin tube, multiple twin tube, and spirallamps | | | | |

SECTION 130.3 – SIGN LIGHTING CONTROLS

(a) Controls for Sign Lighting.

3. **Demand Responsive Electronic Message Center Control.** An Electronic Message Center (EMC) having a new connected lighting power load greater than 15 kW shall [meet Demand Responsive Control Requirements in Section 110.x.](#) ~~have a control installed that is capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal.~~

~~**EXCEPTION to Section 130.3(a)3:** Lighting for EMCs that is not permitted by a health or life safety statute,~~

~~ordinance, or regulation to be reduced by 30 percent.~~

SECTION 130.5 –ELECTRICAL POWER DISTRIBUTION SYSTEMS

- (e) **Demand responsive controls and equipment.** ~~When Demand Responsive Controls are installed, they must meet Demand Responsive Control Requirements in Section 110.x(a). Demand responsive controls and equipment, where installed, shall be capable of receiving and automatically responding to at least one standards based messaging protocol which enables demand response after receiving a demand response signal.~~

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

- (a) **Alterations.**

2. **Prescriptive approach.**

- E. **Altered Space-Conditioning Systems.** When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:
- i. ~~For a~~All altered units where the existing system has ~~thermostatic controls does not comply with Reference Joint Appendix JA5, the existing thermostat~~ shall be replaced with a thermostatic controls that complies with Reference Joint Appendix JA5.
 - ii. All newly installed space-conditioning systems requiring a thermostatic controls shall ~~be equipped with a thermostat that~~ have thermostatic controls that comply ~~ies~~ with Reference Joint Appendix JA5;and
 - iii. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed, if the duct system meets the criteria of Sections 140.4(1)1, 2 and 3, as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Nonresidential Appendix NA2, and conforming to the applicable leakage compliance criteria in Section 141.0(b)2D.

EXCEPTION 1 to Section 141.0(b)2Eii: Duct Sealing. Buildings altered so that the duct system no longer meets the criteria of Sections 144 (1)1, 2, and 3 are exempt from the requirements of Subsection 141.0(b)2Eii.

EXCEPTION 2 to Section 141.0(b)2Eii: Duct Sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Reference Nonresidential Appendix NA2 are exempt from the requirements of Subsection 141.0(b)2Eii.

EXCEPTION 3 to Section 141.0(b)2Eii: Duct Sealing. Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2Eii.

SECTION 150.0 – MANDATORY FEATURES AND DEVICES

- (i) **Thermostats.** All unitary heating or cooling systems, including heat pumps, not controlled by a central energy management control system (EMCS) shall have a ~~setback~~ thermostatic controls that meet the requirements, as specified in Section 110.2(c).

SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS

- (c) **Prescriptive Standards/Component Package.**

7. Space Heating and Space Cooling.

- A. **Refrigerant Charge.** When refrigerant charge verification or fault indicator display is shown as required by TABLE 150.1-A, the system shall comply with either 150.1(c)7Ai or 150.1(c)7Aii:
- i. air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, and mini-split systems, shall comply with subsections a, b and c, unless the system is of a type that cannot be verified using the specified procedures:
 - a. Have measurement access holes (MAH) installed according to the specifications in the Reference Residential Appendix Section RA3.2.2.3; and
 - b. System airflow rate greater than or equal to 350 cfm per ton shall be demonstrated by the installer and be verified by the HERS rater as specified by Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified by RA1; and
 - c. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable:
 - I. The installer and rater shall perform the standard charge procedure as specified by Reference Residential Appendix Section RA3.2.2 or an approved alternative procedure as specified by RA1; or
 - II. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or
 - III. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the RA3.2.2 standard charge verification procedure and RA3.3 airflow rate verification procedure or approved alternatives in RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in RA1.

EXCEPTION to Section 150.1(c)7Aia: Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1, shall not be required to provide holes as described in Figure RA3.2-1.

EXCEPTION 1 to Section 150.1(c)7Aib: The Executive Director may approve alternate airflow rate requirements for small duct high velocity systems.

EXCEPTION 2 to Section 150.1(c)7Aib: Standard ducted systems without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in TABLE-150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.

EXCEPTION 1 to Section 150.1(c)7Aic: When the outdoor temperature is less than 55 degrees F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to verify the refrigerant charge, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section

RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.1(c)7Aib.

Language in the exception highlighted above has not been revised yet, but language may clarify in a future iteration of the draft language.

SECTION 150.2 – ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING LOW-RISE RESIDENTIAL BUILDINGS

(b) Alterations.

1. Prescriptive approach.

- F. Altered Space-Conditioning System - Mechanical Cooling:** When a space-conditioning system is an air conditioner or heat pump that is altered by the installation or replacement of refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping, the altered system shall comply with the following requirements:
- i. All thermostats associated with the system shall be replaced with setback thermostatsic controls that meeting the requirements of Section 110.2(c).
 - ii. In Climate Zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted package systems, and minisplit systems, shall comply with subsections a and b, unless the system is of a type that cannot be verified using the specified procedures. Systems that cannot comply with the requirements of 150.2(b)1Fii shall comply with 150.2(b)1Fiii.
 - a. Minimum system airflow rate greater than or equal to 300 cfm per ton shall be demonstrated by the installer and be verified by the HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified in Section RA1; and
 - b. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable.
 1. The installer and rater shall perform the standard charge verification procedure as specified in Reference Residential Appendix Section RA3.2.2, or an approved alternative procedure as specified in Section RA1; or
 2. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or
 3. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the RA3.2.2 standard charge verification procedure and RA3.3 airflow rate verification procedure or approved alternatives in RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in RA1.

EXCEPTION 1 to Section 150.2(b)1Fiii: Systems unable to comply with the minimum 300 cfm per ton airflow rate requirement shall demonstrate compliance using the procedures in Section RA3.3.3.1.5; and the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5.

EXCEPTION 2 to Section 150.2(b)1Fiia: The Executive Director may approve alternate airflow and fan efficacy requirements for small duct high velocity systems.

EXCEPTION 3 to Section 150.2(b)Fiia: Entirely new or complete replacement space conditioning systems, as specified by section 150.2(b)1C, without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in TABLE- 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.

EXCEPTION 1 to Section 150.2(b)1Fiib: When the outdoor temperature is less than 55 degrees F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to demonstrate compliance, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5. Ducted systems shall comply with the minimum system airflow rate requirements in Section 150.2(b)1Fiia.

Language in the two exception highlighted above has not been revised yet, but language may clarify in a future iteration of the draft language.

EXCEPTION to Section 150.2(b)1Fii: Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiia, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.

- iii. In climate Zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, air-cooled air conditioners or air-source heat pumps, including but not limited to ducted split systems, ducted package systems, and minisplit systems, which are of a type that cannot comply with the requirements of 150.2(b)1Fiib shall comply with subsections a and b, as applicable.
 - a. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix RA3.2.3.2; and
 - b. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.2(b)1Fiia provided the system is of a type that can be verified using the procedures in RA3.3 or an approved alternative procedure in RA1.

EXCEPTION to Section 150.2(b)1Fiii: Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiib, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.

2.2 Reference Appendices

Proposed revisions to NA7.5.10 and JA5 are provided below. The Statewide CASE Team is recommending a complete rewrite of JA5. Instead of providing marked up language for JA5, the new version is provided below without changes tracked. The 2016 version of JA5 is available at the following location for comparison:

http://www.energy.ca.gov/title24/equipment_cert/ocst/Reference_Appendix_JA5.pdf

NA7.5.10 Automatic Demand Shed Control Acceptance

NA7.5.10.1 Construction Inspection

Prior to Acceptance Testing, verify and document the following:

- (a) That the Demand Responsive Control is capable of initiating a control strategy when a Demand Response Signal is received. EMCS interface enables activation of the central demand shed controls.

NA7.5.10.2 Functional Testing

Step 1: Engage the global demand shed system. Verify and document the following:

- (a) That the cooling setpoint in Non-Critical Zones spaces increases by four degrees as required by Section 120.x. the proper amount.
- (b) That the cooling setpoint in Critical Zones spaces do not change.

Step 2: Disengage the global demand shed system. Verify and document the following:

- (c) That the cooling setpoint in Non-Critical Zones spaces return to their original values.
- (d) That the cooling setpoint in Critical Zones spaces do not change.

Note: This version of JA5 does not have changes from the 2016 version tracked. The next iteration will have changes struck and underlined. The 2016 version is available here for comparison:

http://www.energy.ca.gov/title24/equipment_cert/ocst/Reference_Appendix_JA5.pdf

Joint Appendix JA5

Appendix JA5 - Technical Specifications for Demand Response Thermostatic Controls

Table of Contents

| | |
|--|-----------|
| Appendix JA5 - Technical Specifications for Demand Response Thermostatic Controls | 16 |
| JA5.1 Purpose and Scope | 17 |
| JA5.2 Manufacturer Self-Certification of DR Thermostats..... | 17 |
| JA5.3 Definitions | 17 |
| JA5.4 Compliance with Independent Device(s) or Networked Systems of Devices | 17 |
| JA5.5 Communications Requirements | 18 |
| JA5.5.1 Physical Communication Interface..... | 18 |
| JA5.5.2 Logical Communication Interface..... | 18 |
| JA5.5.3 Communication Security | 19 |
| JA5.5.4 Communication Module | 19 |
| JA5.6 Functional Requirements..... | 19 |
| JA5.6.1 Compliance with Section 110.2 and Section 120.2 | 19 |
| JA5.6.2 Automatic Demand Responsive Control | 20 |
| JA 5.6.3 Normal Operation..... | 20 |
| JA5.6.4 Other Capabilities..... | 21 |
| JA5.7 User Display and Interface | 21 |
| JA5.8 HVAC System Interface..... | 22 |

JA5.1 Purpose and Scope

Joint Appendix (JA) 5 provides the technical requirements for Demand Response Thermostatic Controls (DR Thermostats) to comply with the requirements of Title 24, Part 6. DR Thermostats must comply with the specifications included in this appendix or a specification approved by the Executive Director.

The requirements for DR Thermostats included in this appendix are intended to be compatible with National Electrical Manufacturers Association (NEMA) Standard DC 3-2013 Residential Controls – Electrical Wall-Mounted Thermostats and NEMA DC 3 Annex A-2013 Energy-Efficiency Requirements for Programmable Thermostats¹.

Note: When selecting DR Thermostats, it is recommended that the project team work with the local utility to select a control that meets the utility’s eligibility criteria for enrollment and participation in demand response programs.

JA5.2 Manufacturer Self-Certification of DR Thermostats

DR Thermostats are compliant with Title 24, Part 6 only if they have been certified to the Energy Commission. To certify DR Thermostats to the Energy Commission, manufacturers must execute a declaration that the control is in compliance with the applicable requirements in Title 24, Part 6. The manufacturer declaration is executed under penalty of perjury attesting that all information provided is true, complete, accurate, and in compliance with the applicable provisions of this appendix (JA5) and other applicable requirements in Title 24, Part 6. The declaration form is provided by the Energy Commission.²

JA5.3 Definitions

For the purposes of the specifications in Reference Joint Appendix JA5, the following definitions shall apply:

Demand Response is defined in Section 100.1 and Joint Appendix JA1- Glossary.

Demand Response Period is defined in Section 100.1 and Joint Appendix JA1- Glossary.

Demand Response Signal is defined in Section 100.1 and Joint Appendix JA1- Glossary.

Demand Responsive Control is defined in Section 100.1 and Joint Appendix JA1- Glossary.

Thermostatic Control is defined in Section 100.1 and Joint Appendix JA1- Glossary.

JA5.4 Compliance with Independent Device(s) or Networked Systems of Devices

DR Thermostats can be an independent devices or control systems comprised of multiple

¹ NEMA DC 3-2013 and NEMA DC 3 Annex A-2013 are available here: <http://www.nema.org/news/Pages/NEMA-Publishes-Thermostat-Standards-NEMA-DC-3-2013-and-NEMA-DC-3-Annex-A-2013.aspx>

² The Demand Responsive Thermostatic Control Declaration form is available on the California Energy Commission’s website: http://www.energy.ca.gov/title24/equipment_cert/ocst/index.html

devices³. An independent device is compliant if it meets all requirements in Sections JA5.5 through JA5.7. For a control system comprised of multiple devices to be compliant, the networked system of devices must meet the requirements in Section JA5.5 through JA5.7 when all devices in the system are considered as a whole. A thermostat unit, for example, might meet the requirements as an independent device.

JA5.5 *Communications Requirements*

JA5.5.1 Physical Communication Interface

The physical communications interface describes the physical connection through which Demand Response Signals are received. The requirements for the physical communications interface include:

1. All DR Thermostats shall be capable of bi-directional exchange of information.
2. DR Thermostats for use in low-rise residential buildings shall be capable of receiving Demand Response Signals that have been transmitted using one of the following physical interfaces:
 - a. A Wi-Fi network compliant with Institute of Electrical and Electronics Engineers (IEEE) Standard 802.11; or
 - b. A Zigbee network compliant with IEEE Standard 802.15.4.
3. DR Thermostats for use in nonresidential high-rise residential, or hotel-motel buildings shall be capable of receiving Demand Response Signals that have been transmitted using one of the following physical interfaces:
 - a. A Wi-Fi network compliant with Institute of Electrical and Electronics Engineers (IEEE) Standard 802.11; or
 - b. A Zigbee network compliant with IEEE Standard 802.15.4.
 - c. An Ethernet network compliant with IEEE Standard 802.3.

DR Thermostats can have the capability of using an additional other wireless or wired (proprietary or non-proprietary) physical communication interfaces.

JA5.5.2 Logical Communication Interface

The logical communication interface describes the information model and its messaging protocol used for representation and interpretation of Demand Response Signals. **All DR Thermostats must comply with Open ADR 2.0 ⁴or Smart Energy Profile (SEP) 1.1^{5,6}**

DR Thermostats can have the capability of using an additional logical communication

³ A networked system of devices, for example, could be comprised of a wired or wireless gateway, temperature sensors located throughout the building, and temperature setpoint controls for each Zone.

⁴ OpenADR 2.0 is available here: <http://www.openadr.org/specification-download>

⁵ The Smart Energy Protocol (SEP) 1.1 is available here: <http://www.zigbee.org/zigbee-for-developers/applicationstandards/zigbeesmartenergy/>

⁶ Open ADR 2.0 and SEP 1.1 are both open-based standards that are listed in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS), which is available here: <http://collaborate.nist.gov/wiki-sggrid/bin/view/SmartGrid/SGIPCoSStandardsInformationLibrary>

protocols.

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 language highlighted may be revised before the next iteration of the language is released.

JA5.5.3 Communication Security

The communications system shall consider relevant security issues and potential cyberattacks.

The language highlighted above will like be revised before the next iteration of the language is released.

JA5.5.4 Communication Module

The communication module enables the communications requirements of the DR Thermostats, including the requirements in JA5.5.1 through JA5.5.3. The communication module must be either integrated with the thermostatic control (onboard; not removable), or removable with connection⁷ to the thermostatic control by means of an expansion port.

JA5.5.4.1 Onboard Communication Module

DR Thermostats with onboard communication modules shall have the capability to enable or disable communication using an interface that is readily accessible to the occupant.

When onboard communications are disabled, the DR Thermostats shall continue to meet the appropriate requirements in Sections 110.2(b), 110.2(c), 120.1(a) and 120.1(b).

JA5.5.4.2 Removable Communication Module with Expansion Port

DR Thermostats with removable communication modules shall have an expansion port that is readily accessible to the occupant for the removal and/or installation of the communication module.

The removable communication module may also provide a means of memory storage, logging, and firmware upgrades.

When the expansion port is unpopulated (i.e., the communications module is removed), the DR Thermostats shall continue to meet the appropriate requirements in Sections 110.2(b), 110.2(c), 120.1(a) and 120.1(b).

JA5.6 Functional Requirements

JA5.6.1 Compliance with Section 110.2 and Section 120.2

All DR Thermostats shall meet the requirements of Section 110.2(c).

DR Thermostats used to control heat pumps with supplemental electric resistance heaters shall meet the requirements of Section 110.2(b).

⁷ The removable communication module does not need to be installed at the time of certification. It can be selected and installed at the time of enrollment in a utility demand response program.

DR Thermostats used in nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.2(a) through 120.2(k).

JA 5.6.2 Normal Operation

When the DR Thermostat is not implementing a control strategy during a Demand Response Period, it is performing under normal operation. During normal operation, the DR Thermostats shall continue to meet the appropriate requirements in Sections 110.2(b), 110.2(c), 120.1(a) and 120.1(b) and control temperature following a temperature setpoint schedule. Under normal operation, the DR Thermostats shall have the capability of establishing unique temperature setpoints for at least four operating periods during each 24-hour day.

JA5.6.3 Demand Responsive Control Strategy

DR Thermostats must be capable of automatically implementing a control strategy after receiving a Demand Response Signal⁸. DR Thermostats shall:

1. Be programmed with the following default control strategies:
 - a. For Demand Response Signals that requests a modification to electricity consumption for a limited time period:
 - i. Adjust temperature setpoints up 4°F for cooling
 - ii. Adjust temperature setpoint down 4°F for heating
 - iii. Temperature setpoints shall not be set above 90°F or below 50°F.⁹
 - b. For Demand Response Signals that are an indication of price:
 - i. Adjust temperature setpoint in cooling mode to 82°F and hold setpoint for the duration of the Demand Response Period.
 - ii. Adjust temperature setpoint in heating mode to 60°F and hold setpoint for the duration of the Demand Response Period.
 - c. For all Demand Response Signals, ignore programmed temperature setpoint adjustments if the control strategy setpoints are lower (in cooling mode) or higher (in heating mode) than the temperature setpoint in effect before the Demand Response Period begins.
2. Be capable of allowing occupants or the occupants' representative (e.g., service provider) to modify the default control strategy by:
 - a. Establishing occupant-defined temperature setpoint adjustments
 - b. Establishing occupant-defined start times for the control strategy
 - c. Establishing occupant-defined maximum and minimum temperature setpoints.

⁸ A Demand Response Signal can communicate pricing or a request to modify electricity consumption for a limited time period.

⁹ Establishing maximum and minimum temperature setpoints protects the building from extreme temperatures that might otherwise be imposed if the occupant already had a very high or low temperature setpoint in effect before the Demand Response Period commenced.

Note: The DR Thermostat can provide additional occupant adjustments to the default control strategies.

3. Be capable of automatically implementing unique control strategies for the following types of Demand Response Signals¹⁰:
 - a. An indication of price; and
 - b. A request to modify electricity use for a limited period of time.
4. Be capable of automatically implementing a control strategy in response to a Demand Response Signal that is an indication of price only when the occupant-defined price threshold is exceeded.
5. Be capable of initiating a control strategy (thereby commencing the Demand Response Period) immediately after receiving a Demand Response Signal or at a specific start time as indicated in the Demand Responses Signal.
6. Be capable of continuing the control strategy for the duration of the Demand Response Period.
7. Allow occupants to override or modify a control strategy at any time, including in the middle of a Demand Response Period.
8. Automatically adjust the temperature setpoints upon conclusion of the Demand Response Period or if occupant overrides the control strategy in one of the following ways:
 - a. Restore temperature setpoints that were in existence just prior to the start of the Demand Response Period; or
 - b. Adjust temperature setpoints to the setpoints that are programmed to restore at the conclusion of the Demand Response Period.

JA5.6.4 Other Functional Requirements

JA5.6.4.1 User Display and Interface

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

1. communications system connection status;
2. an indication that a Demand Response Period or pricing event is in progress;
3. other maintenance-related information;
4. the currently sensed temperature; and
5. the current setpoint.

JA5.6.4.1 Restore Default Settings

The DR Thermostats shall include the capability to allow the occupant to restore the factory-installed default settings.

¹⁰ The occupant would have the option of using similar or identical control strategies for signals that indicate price or signals that request a modification in electricity use.

JA5.6.4.3 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 DR Thermostats shall automatically restore the most recently programmed settings, including reconnection to a network, if the device was previously enabled and network connectivity is available.

JA5.6.4.4 Automatic Rejoin

DR Thermostats are expected to connect, and remain connected in its communication path and control end point. The DR Thermostats shall incorporate an automatic rejoin function. When physical and/or logical communication is lost, the DR Thermostats shall trigger its automatic rejoin function to restore the physical and/or logical communication.

JA 5.6.4.5 Clock Operation

1. Clock accuracy must have a precision of one minute.
2. Clock may be set manually by the occupant, or when communications are enabled, it may be set or synchronized by the occupant's selected service provider.

JA5.7 HVAC System Interface

HVAC wiring terminal designations shall be clearly labeled. DR Thermostats shall use labels that comply with Table 5-1 in NEMA DC 3-2013. It is noted that DR Thermostats using wired or wireless digital data interfaces do not directly follow NEMA DC 3-2013.