NEW REQUIREMENTS IN THE 2019 CALIFORNIA TITLE 24 BUILDING ENERGY EFFICIENCY STANDARDS FOR RETAIL SPACES

Prepared by Dialectic
INTRODUCTION

Background
On January 1, 2020, the California 2019 Building Energy Efficiency Standards (BEES) become effective, replacing the 2016 version. California is striving for all newly constructed commercial buildings to be Zero Net Energy (ZNE) by 2030, with 50% of commercial buildings retrofitted to ZNE by 2030. This update to the energy standards is the last of three updates moving California toward that goal. Several changes will have an impact on remodel and new-construction retail projects. These changes affect building envelope, HVAC systems, indoor lighting levels, lighting controls, and exterior lighting. The purpose of this paper is to identify changes that have the largest effect on retail construction.

How to use this paper
This paper is not a comprehensive analysis of all of the changes to the BEES. Rather, it is a guide to identify those items that we believe may cause the highest cost and/or largest fundamental changes to national retail client prototypes and standards. When appropriate, commentary on the effects for retailers is included.
BUILDING ENVELOPE

Fenestration
Glass requirements have not changed compared to the 2016 BEES. Fixed windows require maximum U-factor of 0.36, maximum relative solar heat gain coefficient of 0.25, and minimum visible transmittance of 0.42. New requirements were added for tubular daylighting devices.

Demising Wall Insulation
There were no substantial changes to the requirements of demising wall insulation. Demising walls must be insulated to meet maximum U-factor of 0.099 for wood-framed walls, and maximum U-factor of 0.151 for metal-framed walls. Demising walls constructed of brick, masonry units, or solid concrete are not required to be insulated.

Low-Slope Cool Roof
Minimum aged solar reflectance remains unchanged at 0.63 for new construction and alterations, or Solar Reflectance Index (SRI) of 75 in all climate zones. The following Cool Roof Rating Council (CRRC) website can be used to identify manufacturers who have complying products. http://coolroofs.org/products/results
HVAC

Prescriptive Threshold for Economizers
The economizer requirements for the 2019 BEES are the same. The standards continue to require economizers on all units sized for 54,000 Btu/h (4.5 tons) and larger.

Economizer Fault Detection
Economizer Fault Detection and Diagnostics (FDD) continue to be mandatory for all newly installed, air-cooled, direct-expansion HVAC units equipped with economizers that have a capacity of 54,000 Btu/h (4.5 tons or greater).

Controllers shall be capable of displaying the value of each sensor and indicating status as follows:
- Free cooling available
- Economizer enabled
- Compressor enabled
- Heating enabled (if system is capable of heating)
- Mixed-air low-limit cycle active

The FDD system shall detect the following faults:
- Air temperature sensor failure/fault
- Not economizing when it should
- Economizing when it should not
- Damper not modulating
- Excess outdoor air

The only change in the 2019 BEES is that although FDD systems are still required to be certified by the California Energy Commission (CEC), there is now an exception that FDD algorithms based in direct digital controls systems are not required to be certified by the CEC.

Modulating Cooling Capacity for HVAC Systems
Direct-expansion (DX) HVAC equipment is still required to have the capability to stage or modulate cooling capacity. DX units with a capacity greater than 65,000 Btu/h (5.4 tons) that control the capacity of the unit based on space temperature, must have minimum of two (2) stages of cooling. In addition to staging the cooling, the supply fan air flow must also vary as a function of load meaning that as the cooling stages, the fan shall too. The supply fan on units with a capacity greater than 65,000 Btu/h, must have a minimum of two stages of fan control.
Fortunately, most of the major packaged rooftop unit manufacturers currently have equipment available that meet this requirement.

HVAC Equipment Efficiency
The efficiency requirements for packaged air-cooled HVAC equipment has remained consistent between 2019 and 2016. Packaged air-cooled HVAC equipment from 5.4 to 11.1 ton capacities must have a minimum Energy Efficiency Rating (EER) of 11.2, and minimum Integrated Energy Efficiency Rating (IEER) of 12.9. Packaged air-cooled HVAC equipment from 11.2 to 19.9 ton capacities must have a minimum EER of 11.0, and minimum IEER of 12.4. Packaged air-cooled HVAC equipment from 20 to 63 ton capacities must have a minimum EER of 10.0 and minimum IEER of 11.6.
Changes to HVAC equipment efficiencies within the 2019 BEES include the following:

1. Cooling and heating minimum efficiency requirements for Single Package Vertical Air Conditioners (SPVAC) and Single Packaged Vertical Heat Pumps (SPVHP) have increased to 11.0 EER and 3.3 COP for units less than 5.4 tons.

2. IEER requirements for air-cooled Variable Refrigerant Flow (VRF) air conditioners without heat or with electric heating have increased to 15.5 IEER for units from 5.4 tons but less than 11.25 tons, 14.9 IEER for units from 11.25 tons but less than 20 tons, and 13.9 IEER for units 20 tons and larger.

Air Filtration Requirements
New to the 2019 BEES is the requirement for minimum MERV 13 filters in HVAC systems, in lieu of previously allowed MERV 6 filters. MERV 13 are available in standard 2-inch-thick filter sizes.

Optimum Start/Stop Controls
The 2019 BEES continues to require optimum start/stop controls for most HVAC systems. New in 2019 is systems that must operate continuously are now exempt from optimum start/stop controls.

Demand-Response HVAC Controls
Also new to the 2019 BEES is a requirement for thermostats to be certified with the CEC. Thermostats must be “occupant controlled smart thermostats” and, at minimum, be capable of the following:

1. Automatically restoring most recent programmed settings upon power loss to thermostat.
2. Event response control which automatically adjusts the thermostat set-point offsets based on either a price signal or demand-response signal. Thermostat shall include an override function for event responses.

3. Displaying information to the user:
   - Communications system connection status
   - Indicate that a demand-response period or pricing event is in progress
   - Current space temperature
   - Current space set-point

Pipe Insulation
Pipe insulation exemptions for piping serving process loads, gas piping, cold domestic water, condensate drains, roof drains, vents or waste piping have been removed. In order to clarify piping insulation requirements, the pipe insulation thickness table has added R-values in addition to the existing conductivity range. The pipe insulation table in the 2019 BEES (on page 4, of this paper) has also been updated to note that insulation thicknesses are based on energy efficiency consideration issues only and that water vapor permeability or surface condensation may require vapor retarders or additional insulation.
**New Requirements in the 2019 California Title 24 Building Energy Efficiency Standards for Retail Spaces**

### TABLE 120.3-A PIPE INSULATION THICKNESS

<table>
<thead>
<tr>
<th>Fluid Operating Temperature Range (°F)</th>
<th>Insulation Conductivity</th>
<th>Nominal Pipe Diameter (in inches)</th>
<th>Minimum Pipe Insulation Required (Thickness in inches or R-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conductivity (in Btu-in/h-ft²-°F)</td>
<td>Mean Rating Temperature (°F)</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 350</td>
<td>0.32-0.34</td>
<td>250</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
<tr>
<td>251-350</td>
<td>0.29-0.32</td>
<td>200</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
<tr>
<td>201-250</td>
<td>0.27-0.30</td>
<td>150</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
<tr>
<td>141-200</td>
<td>0.25-0.29</td>
<td>125</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
<tr>
<td>105-140</td>
<td>0.22-0.28</td>
<td>100</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
</tbody>
</table>

**Space cooling systems (chilled water, refrigerant and brine)**

<table>
<thead>
<tr>
<th>Fluid Operating Temperature Range (°F)</th>
<th>Insulation Conductivity</th>
<th>Nominal Pipe Diameter (in inches)</th>
<th>Minimum Pipe Insulation Required (Thickness in inches or R-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conductivity (in Btu-in/h-ft²-°F)</td>
<td>Mean Rating Temperature (°F)</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>40-60</td>
<td>0.21-0.27</td>
<td>75</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
<tr>
<td>Below 40</td>
<td>0.20-0.26</td>
<td>50</td>
<td>Inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-value</td>
</tr>
</tbody>
</table>

Footnote to TABLE 120.3-A:

1. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

2019 Building Energy Efficiency Standards: Section 120.3 – Requirements for Pipe Insulation, Table 120.3-A Pipe Insulation Thickness, page 149 – California Energy Commission. © 2019 State of California
INDOOR LIGHTING

Mandatory Measures
Not much changed with mandatory measures. Other than dedicating a section to and expanding on the requirements for each device type, such as dimmers and outdoor lighting controls, the biggest addition to the section was the inclusion of a table outlining the decibel levels for ultrasonic occupancy sensors. The 2019 BEES also added requirements for radiation levels for microwave-based occupancy sensors.

Lighting Power Density
The 2019 BEES allows for three (3) different calculation methods for building and spaces:
1. Complete Building
2. Tailored
3. Area Category Method

Commercial/retail applications will most likely use either the Tailored or the Area Category Method. Within commercial/retail applications, typically the Tailored Method is better suited for smaller retailers, while the Area Category Method tends to produce more desirable results for big box retailers. The 2019 BEES made minor adjustments to the Lighting Power Density (LPD) allowed for each space type the retail LPD was adjusted from 1.2 W/sf to 1.0 W/sf. Additionally, fitting room areas have a separate LPD (0.60 W/sf) from the retail LPD.

Track Lighting
The California BEES has had the highest track lighting penalty of all the major energy codes. Due to lighting advancements, the track penalty has decreased from 45 W/lf to 30 W/lf. Additionally, the current limiter section of the code has been simplified and has removed the 12.5 W/lf penalty that was required when using track mounted current limiters.

Automatic Daylight Controls
The 2019 BEES has updates to daylighting controls that are enormous for many retailers. Per the new exemption, retail merchandise sales and wholesale showroom areas no longer require sidelit automatic daylight controls. Additionally, there are exemptions for skylit zones surrounded by larger buildings that obstruct sunlight, as well as for overhangs adjacent to vertical glazing.

Manual Controls
The manual controls section has been streamlined to better identify the intent of the standard. Areas enclosed with ceiling height partitions must have manual controls that allow the end user to turn the lighting on and off. Also, there must be separate controls for each lighting type within each area, such as general, display and ornamental.
Multilevel Controls
The multilevel controls section had little change from the 2016 BEES. Multilevel controls are required in areas 100 ft\(^2\) or larger, or that have a LPD greater than 0.5 W/ft\(^2\). The number of lighting control steps varies depending on the type of lighting used. This can be found in Table 130.1-A. In addition, each light fixture shall be controlled by at least one of the following methods: manual dimming, lumen maintenance, tuning, automatic daylighting controls, or demand-responsive lighting controls.

Shut-off and Automatic Shut-Off
Much like the multilevel control section, the shut-off control section didn’t change much other than formatting. It requires automatic shut-off controls for when spaces are unoccupied. This can be accomplished in a variety of ways including occupant sensing control, automatic time-switch control, a signal from another building system, or some other control capable of shutting off all of the lights. It also requires separate controls for the lighting on each floor, and separate controls for lighting in each room, with each control controlling a maximum of 5,000 ft\(^2\) of lighting. Larger spaces will require separate 5,000 ft\(^2\) control zones, except single-tenant retail spaces can increase the control zone size to a maximum of 20,000 ft\(^2\). Separate controls are also required for general, display, ornamental, and display case lighting.

Retail sales floors are exempt from the requirement for the switches to be readily accessible and located in the same room, but the control is required to be located so that a person using the lighting control can see the lights or area controlled. Otherwise, the lighting control must be indicated with a visual signaling device showing the ON-OFF status of the lights.

Areas that are required to have multilevel controls shall be controlled by “partial-on” occupancy sensors (only 50-70% of the lights shall turn on) or vacancy sensors (manual-on only). Areas not required to have multilevel controls shall be controlled by occupancy sensor, partial-on occupancy sensor, or vacancy sensor.

Demand-Responsive Lighting Control
This requirement applies to all buildings larger than 10,000 ft\(^2\), with LPD greater than 0.5 W/ft\(^2\). Upon receiving a demand-response signal from the utility company, the system must automatically provide a 15% reduction in lighting power by dimming methods outlined in the standard. Each dimming method is dependent on the type of lighting used, such as LED, fluorescent and incandescent. This requirement will affect prototypical lighting control schemes, and will likely require a dimming system to be incorporated into the design.
Threshold for Lighting Alterations
The lighting alteration section has been rewritten to simplify the requirements for building alterations. For lighting compliance, once 10% or more of luminaires are being altered, one of the following requirements must be met:

1. Comply with the normal power and control requirements, or
2. Be better than 80% of the normal power requirements and meet the typical control requirements, or
3. When doing a one-for-one replacement, be better than 40% of the pre-alteration LPD and meet the typical control requirements (this requirement is only for building area or tenant space less than 5,000 sf)

However, the exemptions for this include alterations that only replace luminaire ballast, lamps or drivers, and one-for-one replacement of up to 50 fixtures.

Prescriptive Requirements for Indoor Lighting
The 2019 BEES updated qualifications for general lighting. It also removes the restriction of what can’t be general lighting. This is probably due to the use of track lighting as general lighting in retail applications. However, what is considered wall or floor display lighting is unchanged from 2016.

The code has clarified that lighting internal to display cases that are “attached to a wall or directly adjacent to a wall” is now considered wall display. Depending how a store is designed will determine the effect of this change.

Additionally, in order to qualify for “adjusted indoor lighting power,” the mounting height for floor display lighting has been lowered from 12’ down to 10’ 6”. The code also tightened what qualifies for the ‘floor area display’ allowance. Essentially, they have limited areas on the floor excluding areas that have been “designated as a path of egress.” It is our opinion this would only have an effect if an area has that designation in order to take advantage of night-lighting allowances.
OUTDOOR LIGHTING

Outdoor Lighting Control
In the 2016 BEES, for lighting fixtures mounted less than 24 feet above the ground, the fixtures must have a motion sensor or other controls that automatically control the lighting in response to the area being vacated by occupants. This has not changed in the 2019 BEES. However, the control range has been updated. Exterior lighting controls must be capable of reducing the lighting power of each light fixture by at least 50% (up from 40%) but not exceeding 90% through scheduled unoccupied periods and when the space is unoccupied (motion sensing).

For automatic scheduling, controls must have at least two (2) nighttime periods that have independent lighting levels. This would require the automatic controls to work with motion-sensing controls or other means of dimming the lighting during unoccupied times.

One main exemption added to the code is for luminaires rated less than 40 W. These luminaires do not require motion sensing controls.
OTHER RELEVANT CHANGES

**Solar Readiness**
The 2019 BEES continues to address the requirements for solar zones for new nonresidential buildings, and requires all nonresidential buildings with three habitable stores or fewer, not including healthcare facilities, to be solar-ready. The solar zone is defined as “an allocated space that is unshaded and free of obstructions.” The solar zone can be located on the roof, overhang, roof of another structure located within 250 feet of the primary building, or above covered parking installed with the building project. The solar zone must be at least 15% of the total roof area after subtracting any area of the roof that is covered by a skylight. The main electrical service panel must have a minimum busbar rating of 200 amps, and must have reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation, including permanent marking of the reserved space as “For Future Solar Electric.”

**Commissioning Requirements**
Commissioning continues to be a requirement in the 2019 BEES. All nonresidential buildings and nonresidential spaces within mixed use occupancies 10,000 ft² or greater, will require full commissioning. Commissioning includes the development of:
- Owner’s project requirements
- Basis of design
- Design review
- Commissioning plan
- Functional performance testing
- Documentation and training
- Final commissioning report

In addition, the commissioning measures are required to be shown in the construction documents. The costs of commissioning will vary depending on the size and complexity of the project. These costs have the potential to be substantial, especially since field work is a required part of the commissioning process.

CONCLUSION

The 2019 California Building Energy Efficiency Standards made only incremental changes on how retailers design and construct their stores. Energy codes continue to transition from life safety to sustainability. In addition to the 2019 BEES, the International Green Construction Code (IGCC) and ASHRAE Standard 90.1 are also driving a powerful transformation as they are adopted more widely by state, county, city, and local governments.

We encourage our retail clients to continue to adapt to these code changes and plan prototype changes as soon as possible. In the long term, these code changes will benefit retailers in the form of reduced operating and maintenance costs.

Dialectic engineers have over 30 years of experience with federal, state and local codes and standards. This includes the California Title 24 standards. If you have any questions about how 2019 BEES will affect your business or how to implement the new changes, Dialectic is here to help! To speak with an MEP specialist, call 816-997-9601.