California’s Updated Title 24: Electrical Distribution Compliance
The recently updated California Energy Commission’s Title 24 regulation specifies additional energy monitoring requirements that make smart electrical distribution achievable. As demand for intelligent, more efficient and sustainable building construction increases, there is a need for electrical distribution panels that can adapt/expand with new requirements. This white paper is intended to serve as a guide to help understand Title 24 requirements for electrical distribution panels.

**Introduction**
California’s Title 24, Part 6, Building Energy Efficiency Standards, §130.5 call for the ability to meter various types of electrical loads. Updates to the standard become effective in 2017 and require provisions for metering individual panels or loads, even if the meter is to be installed in the future. Section 130.5 applies to new electrical system installations or when complete electrical systems are replaced. The requirement does not apply to modifications made in existing electrical systems, such as adding a new breaker to an electrical panel.

**What to Monitor**
Depending on the application, different types of metering are required to comply with Title 24, Part 6 §130.5. Applications have been organized into several categories, dependent on the type of branch devices used, and the electrical service rating of the panel.

**For service entrance applications,** a wide variety of metering options are available to meet Part 6 §130.5(a) requirement to monitor the main line side of the panel. Single point meters such as utility-supplied meters, or integrated meters available from the panelboard manufacturer, that provide instantaneous kW monitoring capabilities can meet this requirement.

**Table 130.5-B Minimum Requirements For Separation Of Electrical Load**

<table>
<thead>
<tr>
<th>ELECTRICAL LOAD TYPE</th>
<th>ELECTRICAL SERVICES RATED 50 kVA OR LESS</th>
<th>ELECTRICAL SERVICES RATED MORE THAN 50kVA AND LESS THAN OR EQUAL TO 250 kVA</th>
<th>ELECTRICAL SERVICES RATED MORE THAN 250 kVA AND LESS THAN OR EQUAL TO 1000kVA</th>
<th>ELECTRICAL SERVICES RATED MORE THAN 1000kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting including exit and egress lighting and exterior lighting</td>
<td>Not required</td>
<td>All lighting in aggregate</td>
<td>All lighting disaggregated by floor, type or area</td>
<td>All lighting disaggregated by floor, type or area</td>
</tr>
<tr>
<td>HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers, and circulation pumps associated with HVAC</td>
<td>Not required</td>
<td>All HVAC in aggregate</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50 kVA</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50kVA</td>
</tr>
<tr>
<td>Domestic and service water system pumps and related systems and components</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Plug load including appliances rated less than 25 kVA</td>
<td>Not required</td>
<td>All plug load in aggregate</td>
<td>All plug load separated by floor, type or area</td>
<td>All plug load separated by floor, type or area</td>
</tr>
<tr>
<td>Elevators, escalators, moving walks, and transit systems</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Other individual non-HVAC loads or appliances rated 25kVA or greater</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Industrial and commercial load centers 25 kVA or greater including theatrical lighting installations and commercial kitchens</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Renewable power source (net or total)</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
</tr>
<tr>
<td>Loads associated with renewable power source</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Charging stations for electric vehicles</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
</tbody>
</table>

**For applications with panel board service greater than 50 kVA,** energy consumption monitoring should be grouped by load type, location in building, or in another category as defined by Title 24. The monitoring of load circuits can be easily accomplished with a variety of products readily available in the electrical distribution market.

The ability to monitor different types of electrical loads is outlined in Part 6 Table §130.5(B), provided below:
Expense of Grouping Breakers by Load Type

Grouping breakers into subsections of a panel can consume both time and money. Intricate layouts require engineering time and other resources to design, and require significant attention to detail in the physical wiring. Material costs increase along with the panel footprint as bus lengths grow and large current transformers (CTs) are added between the bus bar subsections. This method consumes more space in the panel and subsequently decreases circuit density and flexibility, especially when additional branch devices are needed post-commissioning.

Branch Monitoring Upgrade Solution

Branch Circuit Monitoring (BCM) upgradable panels are a practical, cost effective way to meet Title 24 Part 6 §130.5(b) requirements. This method provides freedom to place branch devices anywhere in a panel regardless of load type. This means that panels can be installed with less labor since there is no further time dedicated to validating the construction of a complex layout.

Further, up-front investment in CTs and meters is not required as Title 24 requires that provisions be made for the ability to monitor loads in the future. When the decision to add a meter is made, measurements can be aggregated into the desired grouping. This can be achieved without removing or rewiring the branch devices, regardless of their location inside the panel.

The BCM upgradable panel remains Title 24 compliant when one load type is wired per branch, as is the requirement for many other Title 24 solutions.

BCM Kit Installation

When the decision to install a BCM upgrade kit is made, the process to implement in the field is simple, with minimal downtime. Since the panel is already sized to hold a meter, upgrade kits can be quickly installed without impact to panel footprint. Split core CTs enable installation without removal or rewiring of branch devices. The field-installable upgrade path is illustrated below:

![BCM Kit Installation Diagram]

Figure 1: BCM Ready Panel comes with provisions to mount the upgrade kit to enable metering once it is required. BCM upgrade kits contain current transformers and meter. Together, these two parts create a fully metered panel.

BCM Upgrade Compliance Validation

Example 8-8, from the California Energy Commission’s Nonresidential Compliance Manual illustrates how a BCM panel, where each circuit is serving only one load type, meets §130.5(b) requirements by providing for future CTs and meter installation. The example from the Compliance Manual is provided below:

![BCM Upgrade Compliance Validation Diagram]
Conclusion

Branch Circuit Monitoring (BCM) upgradable panel boards allow the ability to meter each branch circuit individually without the complexity and cost of physically grouping similar branch devices together within the panel. Title 24 compliance can be attained with BCM upgradable panels no matter where a branch device is located in the panel, provided a single load type is wired per branch. The BCM upgradable panel boards provide more installation flexibility and better density per panel than disaggregated load monitoring.

The field upgrade kit can be installed after the panel is commissioned. The kits include a meter and split core CTs. BCM upgradable panels retain density and flexibility when adding additional branch devices regardless if metering has been implemented.

Planning for future branch circuit monitoring provides much needed flexibility in panel layout, capability, and breaker density while still meeting California Title 24 requirements for the ability to meter by load type.

BCM upgradable panels deliver the benefit of installing simple, low cost panels that meet current regulatory needs while still providing a cost effective, compact path to be ready for the future.

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