

March 29, 2015

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California Energy Commission

**DOCKETED****15-BSTD-01**

TN # 75542

MAR 30 2015

**Re: Docket # 15-BSTD-01 Proposed Revisions to NA7.6.3 –  
Area Weighted Calculations for Demand Response Testing****Summary of Recommendation**

The percent reduction calculation should use (total initial power – total DR power) / total initial power.

Using the Area Weighted method based on the percent reduction of each individual space provides erroneous results because the Area Weighted method depends on using values which have real dimensions and not on percentages which are unitless.

**As currently written:****Sec 130.1(e) Demand Responsive Controls.**

*Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Response Signal; so that the building's total lighting power can be lowered by a minimum of 15 percent below the total installed lighting power. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A. Spaces that are non-habitable shall not be used to comply with this requirement, and spaces with a lighting power density of less than 0.5 watts per square foot shall not be counted toward the building's total lighting power.*

**NA7.6.3 Acceptance test for Demand Responsive Controls in accordance with Section 130.1(e).**

*"Test the reduction in lighting power due to the demand responsive lighting control using one of the following two methods."*

*Method 1: Illuminance Measurement. Measure the reduction in illuminance in enclosed spaces required to meet Section 131(b) [should be 130.1(e)], as follows:*

*(b) Full output test*

- 5. Calculate the area-weighted average reduction in illuminance in the demand response condition, compared with the full output condition.*

*Method 2: Current Measurement. Measure the reduction in electrical current in spaces required to meet Section 131(b) [should be 130.1(e)], as follows:*

*(b) Full output test*

- 5. Add together all the circuit currents, and calculate the reduction in current in the demand response condition, compared with the full output condition.*

**Nonresidential Compliance Manual****13.8.4 NA 7.6.7 Demand Responsive Acceptance**

## At-A-Glance

### Instrumentation

*This test requires either an illuminance meter or a **power** meter (with a current transformer and voltmeter).*

#### Comment:

1. Sec 130.1(e) talks about lighting power reduction where power is measured in watts.
2. Sec 130.1(e) does not mention illuminance or area weighted or current or VA.
3. The calculation example given on page 132 of the Compliance Manual: Line f is a percentage, and Line h is also a percentage involving Line f. Hence Line h is a percentage of percentages which I remember from high school math provides an erroneous result.
4. A resolution to this problem is to remember that illuminance is lumens per unit area and in this case it is lumens per sq ft. And going back to basics, lumens is a measure of luminous power, hence each footcandle measurement needs to be converted into luminous power per space or footcandles of each space times the area of each space. The aggregate percentage change would be:  
$$\frac{\sum \text{change in luminous power per space}}{\sum \text{initial electrical luminous power per space}} \times 100$$
5. Now, since the numerator and the denominator are both in units of luminous power the quotient will be a legitimate percentage.

#### Suggestion:

1. Change Line h (demand response reduction measured in percent) to:

$$\frac{g1(b1-d1) + g2(b2-d2) + \dots}{(g1 \times b1-e1) + (g2 \times b2-e2) + \dots} \times 100$$

$$(g1 \times b1-e1) + (g2 \times b2-e2) + \dots$$

Where:

Line b is the initial illuminance measured in footcandles

Line d is the illuminance in demand response condition measured in footcandles

Line e is the illuminance provided by daylight without electric light measured in footcandles

Line g is the area of each space measured in sq ft

Line e is not needed in the numerator because:  $(b1-e1)-(d1-e1) = b1-e1-d1+e1 = b1-d1$

Line f (calculation of percent reduction per space) in the procedure is not needed.

2. DEMAND RESPONSIVE LIGHTING CONTROL ACCEPTANCE DOCUMENT –  
NRCA-LTI-04-A

#### Method 1: Illuminance Measurement

Per discussion above, Line h should be changed to:

$$\frac{g1(b1-d1) + g2(b2-d2) + \dots}{(g1 \times b1-e1) + (g2 \times b2-e2) + \dots} \times 100$$

## Method 2: Power Input Measurement

Per discussion above, Line g should be changed to:

$$\frac{f1(b1-d1) + f2(b2-d2) + \dots}{(f1 \times b1-e1) + (f2 \times b2-e2) + \dots} \times 100$$

This proposed calculation revision would change the example on page 132 in the Compliance Manual from 33% to 30% which is not that significant, but the proposed revision is driven home in the CALCTP CLCATT course material in Exercise #3 Floor Plan 2 where the change is from 15.2% to 13.9% and in Floor Plan 3 where the change is from 26.8% to 24.3%. These changes may not appear significant, but Floor Plan 2 changes from Pass to Fail.

The current calculation procedure puts me as a licensed professional engineer in a predicament of complying with a law which is technically wrong.

Thank you for your consideration of these comments.

Respectfully submitted,



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Attachment: Spreadsheet of Proposed Revision to NA7.6.3 – Area Weighted Calculations for Demand Response Testing