

DOCKETED

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Philips Lighting Comments on Title 20 - 45 Day language 10-15-16

Tried submitting this yesterday, but there were network issues.

Additional submitted attachment is included below.



December 7, 2015

Submitted via email: docket@energy.ca.gov

Mr. Andrew McAllister
Commissioner
California Energy Commission
1516 Ninth Street
Sacramento, California 95814

Docket No.: 15-AAER-6

Comments on Title 20 - 45 Day Language - Small Diameter Directional Lamps, General Purpose LED Lamps, and Portable Luminaires

Dear Commissioner McAllister,

Philips Lighting appreciates the opportunity to provide the attached comments on the proposed 45-Day Language issued October 16, 2015 for Small Diameter Directional Lamps, General Purpose LED Lamps, and Portable Luminaires.

As a diversified technology, health, and well-being company focused on improving people's lives, innovation has long been a cornerstone of our company strategy and over the last 120 years has created a strong and trusted Philips brand with market access all over the world. Philips is always looking to tomorrow to understand how light will improve and influence our lives in the future.

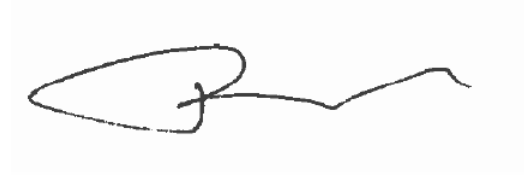
Our history in North America began in 1933, and today, North America is our largest single market in the world, with approximately 22,000 employees and operations at 55 major facilities in 25 states, and across 3 Canadian provinces. In California alone, we have almost 1000 employees. Sales for the region in 2013 were more than \$9.5 billion accounting for more than 30% of Philips global revenue.



Lighting systems from Philips beautify spaces and transform environments. As leaders in the LED technology revolution and the evolution of lighting solutions, we create lighting systems that prioritize energy efficiency, sustainability, and operational cost reduction. We focus on improving the livability and effectiveness of indoor and outdoor environments, providing everything from functional general illumination to spectacular color-changing experiences that reduce energy consumption, enhance brand, encourage social interactions, and revitalize communities.

Please contact me if you have any questions about these comments.

Sincerely,

A handwritten signature in black ink, appearing to read 'David Woodward', is centered on a light gray rectangular background.

Dr. David Woodward
Standards and Regulations Manager Americas
Philips Lighting

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Comments on Title 20 - 45 Day Language (10/16/15)

Small Diameter Directional Lamps, General Purpose LED Lamps, and Portable Luminaires

December 7, 2015

Philips Lighting appreciates the opportunities afforded by the Energy Commission to speak at the public hearing on November 18, 2015 and to submit written comments on the proposed 45 day language for small diameter directional lamps, general purpose LED lamps, and portable luminaires. These written comments include some topics we mentioned at the public hearing and others that are new.

We recognize California's goal to reduce greenhouse gas emissions by harnessing the energy savings offered by LED light sources through the development of efficiency standards for these products.

Philips Lighting strongly supports this goal, however, we are concerned that California will fail to meet it if the 45 day language is enacted without revision. We believe that the scope of the 45 day language is so broad, and the various requirements taken together are so restrictive, that the overall effect will slow the adoption of LED products and greatly reduce the amount of actual energy savings it is possible to achieve with more reasonable efficiency standards.

Our comments will show that the proposed 45 day language will:

- Penalize California consumers financially. They will have no choice but to buy more expensive and less efficient bulbs than consumers in the rest of the country.
- Reduce the availability of LED lamps in California by at least 70-90%, depending on the product type.

We will also address a number of significant oversights in the language that merit correction.

We ask that the Commission review our comments and recommendations, and address them with new 15 or 45 day language.

In future rulemakings, we hope to see a greater level of scrutiny towards the requirements and associated technical analyses before regulatory language is published for comment. In particular, Philips and our industry colleagues wasted many hours investigating the technical feasibility of the Duv limits proposed in the 45 day language. We appreciate that the intended limits were presented by staff at the public hearing and look forward to the publication of new language that includes the correct Duv requirements for review.

Our specific comments and recommendations begin on the following page.

COMMENTS

Scope

Understanding the scope and timing of the language is crucial to knowing how the language would affect the market. As we understand it, the scope of the 45 day language includes the following general product types:

- Directional lamps, i.e., reflector product, with a diameter less than 2.25". All technologies are captured here; it is not limited to LED
- Self-ballasted LED lamps, including directional lamps with a diameter larger than 2.25"
- LED retrofit kits. These are designed to install into existing incandescent downlights.
- LED lamps sold prepackaged with a portable luminaire

Our comments will focus on the first two types. The others are addressed in comments from the National Electrical Manufacturers Association (NEMA), Acuity Brands, and others.

As a member of NEMA, we strongly support their comments.

Timing

The implementation dates of the proposed language are as follows:

Product Type	Implementation Date
Self-ballasted LED lamps	January 1, 2017 – Tier 1
LED retrofit kits	January 1, 2017 – Tier 1
Lamps sold with a portable luminaire	January 1, 2017 – Tier 1
Small diameter directional lamps	January 1, 2018

The Tier 2 implementation date of January 1, 2019 is not shown in the above table.

Lamp Availability

In a recent *Sacramento Bee* article, the CEC is attributed as saying that all manufacturers currently produce bulbs that meet the proposed standards.¹ For Philips Lighting, this statement is not true. Based on our analysis of our product offerings, our LED retrofit kits will not meet the proposed language, nor will any of our small diameter directional LED lamps. This would appear to contradict the above statement. In addition, the rulemaking file appears devoid of evidence supporting the assertion made to the media.

¹ Glover, M "State proposing strict standards for LED bulbs, some forms of track lighting", *Sacramento Bee*, November 14, 2015. <http://www.sacbee.com/news/business/article44534283.html>

38 Taking a broader view, the following table examines the general availability of lamps that would
39 be regulated under the proposed language.

40
41

42 Projected Availability of Lighting Products in California based on Title 20, 45 Day Language
43 Base Year is 2015
44

Product Type	Projected Availability		
	2016	2017	2018
Self-ballasted LED lamps	No change	Tier 1 Requirements take effect January 1, 2017 Product availability significantly drops	Product availability low
LED Large Diameter Directional (Diameter > 2.25")	No change		
LED Retrofit Kits	No change		
LED - Small Diameter Directional (Diameter ≤ 2.25")	No change	No change	Product availability significantly drops
CFL (non-directional)	No change	No change	No change if efficacy ≥ 45 LPW
Halogen – Small Diameter Directional*	No change	No change	Not available (45 day language)
Halogen – General Service Lamp	No change	No change	Not available (< 45 LPW)

45
46 * The availability of small diameter directional CFLs would be affected in a similar manner, however, there are very
47 few, if any of these in the market now.
48

49 In 2017, three types of LED products will see their number of models available in the California
50 market reduced significantly as a result of the proposed 45 day language. The lack of
51 availability of these LED products means that consumers in California will continue to purchase
52 halogen lamps and CFLs in 2017, and into 2018.

53
54 We struggle to understand the logic behind an implementation schedule that significantly
55 reduces the availability of LED lamps in 2017 while the sale of halogen lamps and CFLs
56 continues unaffected. The staff report is not clear if the effect of sustained halogen and CFL
57 usage was incorporated into the cost analysis.² Certainly this is not what the Energy
58 Commission intended.
59

² The rulemaking file also appears to be silent on the environmental impact of increased CFL usage and the associated disposal problems.

60 Fewer LED products will be available for the following reasons:

61

- 62 ▪ Products on the market now will not meet the proposed requirements
- 63 ▪ It will take at least a year to design/redesign, test, and market products that comply
- 64 with the proposed language

65

66 Our comments address these reasons in order.

67

68 Product Availability - Existing Products vs. Proposed Title 20 Requirements

69 Taking omnidirectional lamps as an example, the October 2015 staff report indicates 658
70 omnidirectional lamps (E26 and E12 bases) will comply with the Tier 1 equation as of June 15,
71 2015.³

72

73 As a comparison, we analyzed data taken from the October 21, 2015 ENERGY STAR Certified
74 Products List against some of the metrics from the proposed 45 Day language, including the Tier
75 1 equation. Using that date as a snapshot, there were 1634 LED lamps classified as
76 omnidirectional (~ 84 had GU24 bases). The point of the analysis is not the difference between
77 658 and 1634, but to identify 1634 as the base quantity for lamp availability.

78

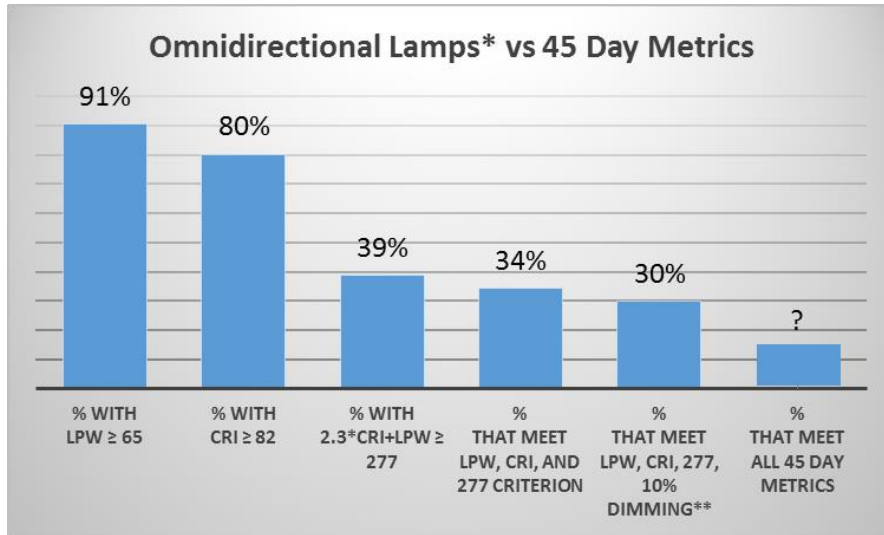
79 The graph on the next page shows that of the 1634 certified lamps, 91% meet the minimum
80 efficacy requirement of 65 LPW and that 80% meet the minimum CRI requirement of 82.
81 However, only 39% of the 1634 lamps meet the proposed Tier 1 compliance score of 277.
82 Combining the LPW, CRI, and Tier 1 metrics, and excluding dimmable lamps that do not dim to
83 10%, we find that only 30% of the 1634 lamps meet the Title 20 language based on these
84 criteria.

85

86 At a minimum, it can be said that at least 70% of the omnidirectional models currently in the
87 market would not meet the Tier 1 requirements in 2017 if the Title 20 language is adopted as
88 written. Other required metrics such as R1-R8 and Duv do not appear on the certified products
89 list. Thus we expect that roughly 90% of the omnidirectional lamps will not meet the
90 requirements. This is based on our knowledge of the metrics since the R1-R8 requirement
91 excludes all lamps with a CRI < 85 and the Duv requirements are overly strict.

92

³ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, page 67.

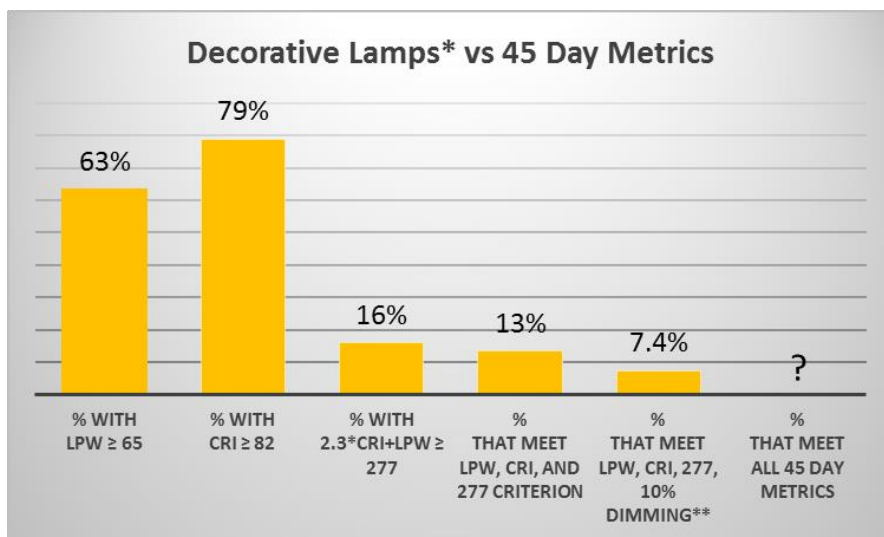


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* 1634 LED lamps were classified as omnidirectional on the 10/21/15 ENERGY STAR Certified Products List.
 ** Lamps that dim to \leq 10% or are non-dimmable.

Similarly, we looked at the data for the lamps characterized as decorative. The data show that at least 92% of the 705 decorative lamps on the Energy Star list will not meet the proposed Title 20 combined criteria for efficacy, CRI, Tier 1 equation, and dimming. As with the omnidirectional lamps, when compliance with the R1-R8 and Duv criteria is factored in, the percentage of compliant lamps will be reduced even further.

Again, with less than 7.5% of the existing decorative LED lamps unavailable in 2017, consumers will continue to use decorative halogen/incandescent lamps and CFLs. This will reduce the anticipated energy savings. The rulemaking file does not appear to contain any evidence that the Commission accounted for this in their analysis.

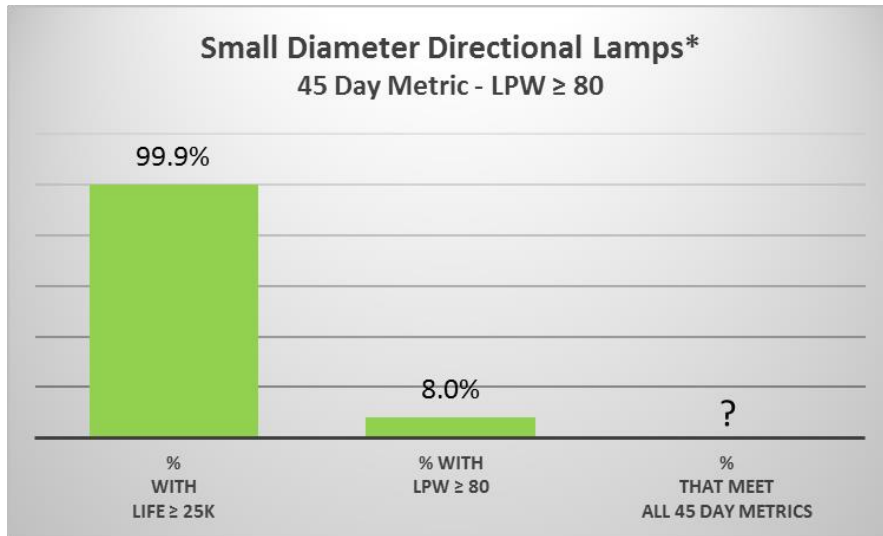


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 110
 111
 112

* 705 LED lamps were classified as decorative on the 10/21/15 ENERGY STAR Certified Products List.
 ** Lamps that dim to \leq 10% or are non-dimmable.

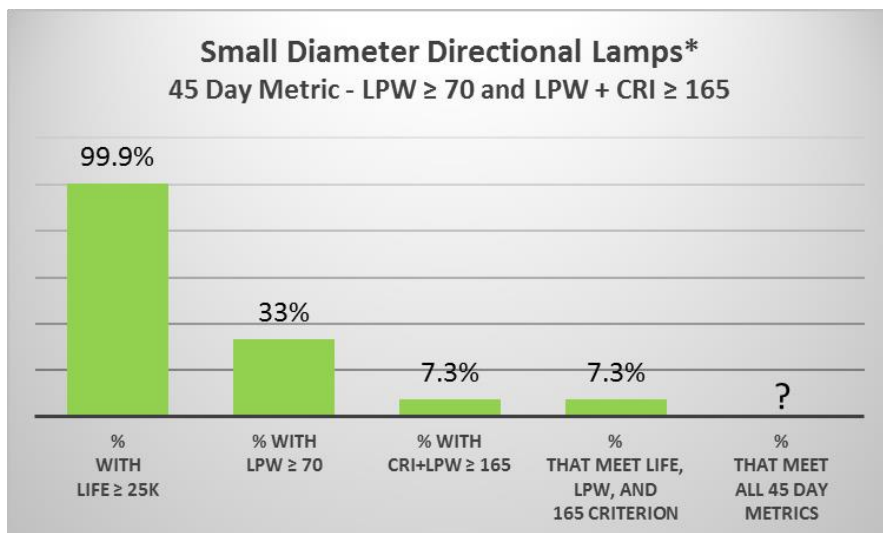
113 The situation with small diameter directional SSL lamps is similar. The proposed 45 day
114 language has two paths for product compliance: lamps with an efficacy of 80 LPW or greater,
115 or lamps with an efficacy of 70 LPW and a combined score of CRI + LPW \geq 165.
116

117 In either case, analysis of the lamps on the certified product list shows that 8% or less of the
118 741 existing lamps will meet the 45 day metrics. This is illustrated in the graphs that follow.
119 Thus, conservatively speaking, 92% of the currently available small diameter directional LED
120 lamps will not be available to California consumers. This is illustrated in the graphs below.
121



122
123
124 * 741 directional LED lamps with diameter less than 2.25" on the 10/21/15 ENERGY STAR Certified Products List.
125

126



127
128
129 * 741 directional LED lamps with diameter less than 2.25" on the 10/21/15 ENERGY STAR Certified Products List.
130

131 Product Availability - New Product Design and Testing

132 As stated above, only a very small percentage of existing LED lamps will meet the proposed
133 requirements in the 45 day language. This means new models will need to be developed or the
134 design of existing models will need to be modified.

135
136 There are two elements of the proposed requirements that create bottlenecks in the product
137 development process: the first is the uncertainty associated with the final DOE test procedure
138 for Integrated LED Lamps; the second is the test procedure called out in the 45 day language for
139 LED life and lumen maintenance, IES LM-84/TM-28.

140
141 The staff report indicates that the final rule for the DOE LED lamp test procedure is expected to
142 be issued in November 2015 before the proposed regulations become effective.⁴ It is now
143 December and the DOE final rule has yet to be issued, and may not be before the regulations
144 are finalized. Furthermore, in both the staff report,⁵ and in the public hearing on November
145 18th, the Commission indicated that they would revise the regulations to match the DOE test
146 procedure.

147
148 This leaves manufacturers in a quandary. Do they start designing and testing now to
149 LM-84/TM-28 which is in both the DOE and CEC proposals, or do they wait until the DOE final
150 rule is issued?

151
152 Regarding the second bottleneck, IES LM-84/TM-28, as Philips mentioned in the public hearing,
153 and as stated in the comments submitted by NEMA, this method is not in common use.
154 IES LM-80/TM-21 is the preferred method for determining lumen maintenance. A lamp
155 manufacturer begins their design with LM-80/TM-21 information from the LED chip
156 manufacturer. The LM-84/TM-28 process would add another 6000 hour test on top of the
157 LM-80/TM-21 testing. This adds approximately 9 months of testing to the product
158 development cycle before a product could be certified. Add a few months on the front end for
159 product design, and a manufacturer will have to start the product development process in
160 January 2016 at the latest to have a product certified to the Commission for January 2017.

161
162 This process would have to be repeated for hundreds of models in order for model availability
163 to return to 2015 levels, stretching problems with availability until late 2017. It is also possible
164 that in the absence of significant changes to the 45 day language, manufacturers could elect
165 only to redesign a portion of their full portfolio for the California market.

166
167 We also wish to caution the Commission that using LM-84/TM-28 as a test procedure does not
168 increase product reliability. These methods only take into account factors that affect lumen
169 maintenance; reliability of the circuit components, for example, is not accounted for. Thus, any
170 thought that using LM-84/TM-28 will improve reliability is unfounded.

171

⁴ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, page 56.

⁵ Ibid.

172 As a way to encourage quicker adoption, once the minimum performance requirements are in
173 place we encourage the Commission to engage California utilities to expand their rebate
174 programs to those lamps that meet the Title 20 minimum requirements.

175

176 **Light Source Color**

177 “The Energy Commission proposes to set minimum color scores rather than a higher overall CRI
178 to allow greater flexibility in LED design.”⁶

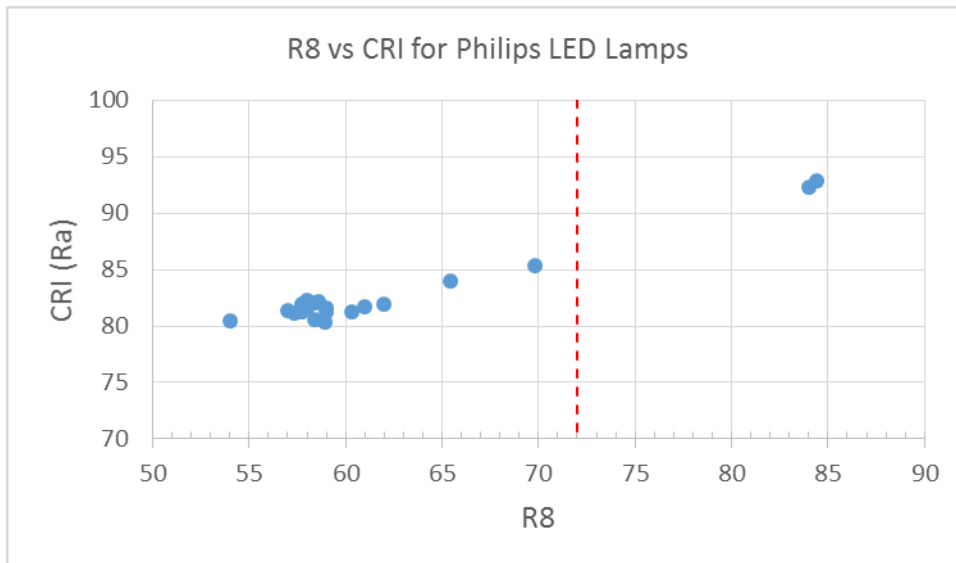
179

180 The above statement from the staff report is disingenuous. The required minimum color score
181 of 72 for the individual color indices of R1 to R8 cannot be achieved at the minimum required
182 CRI of 82, except possibly at color temperatures of 5000K or higher.

183

184 At CCTs of 2700-3000K, which the Commission proposes for lamps claiming incandescent
185 equivalency, lamps with R1 to R8 greater than or equal to 72 have CRIs greater than 85.
186 Appendix A has a table with data for 22 Philips LED models and in all cases where R1 through R8
187 is 72 or greater, the CRI is over 90. Below is a graph for the R8 of these same lamps vs CRI and
188 it shows that lamps with an R8 of 72 or greater will have a high CRI. This is the same conclusion
189 reached based on our analysis⁷ of R8 vs CRI from CLTC’s report⁸ on omnidirectional LED
190 replacement lamp performance testing.

191



192

⁶ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, page 65.

⁷ Docket 14-AAER-01, California Energy Commission, Philips Lighting Comments on Small Diameter Directional Lamp and Light Emitting Diode LED Lamps 2014-11-11 TN-74008.pdf. http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/comments/Philips_Lighting_Comments_on_Small_Diameter_Directional_Lamp_and_Light_Emitting_Diode_LED_Lamps_2014-11-11_TN-74008.pdf

⁸ California Lighting Technology Center, *Omni-directional LED Replacement Lamp Performance Testing, Final Report*. http://cltc.ucdavis.edu/sites/default/files/files/publication/140609-report-omni-directional-led-replacement-lamps_rev140807.pdf

193 Given that LED chips are typically binned as CRI 80 or CRI 90, the minimum color scores
194 effectively mandate a product with a CRI of 90. If that’s what the Commission wants, they
195 should state that explicitly in the 45 day language and the Energy Commission should clearly
196 take responsibility for proposing that consumers can only purchase the less efficient and more
197 expensive CRI 90 products.

198
199 We do not see any statistically based evidence in the rulemaking file that consumers actually
200 want or prefer lamps with CRI \geq 90. The staff report references the IES Handbook and suggests
201 that certain residential room types demand color accuracy.⁹ The suggestion that high CRI is
202 needed for limited residential applications should not be the determining factor in setting state
203 minimum performance requirements.

204
205 CRI 80 lamps are almost always more efficient and cheaper than lamps with a CRI \geq 90 based on
206 the laws of physics and the additional design complexity required to achieve 90+ CRIs.

207
208 In order to allow more efficient and cost effective LED products to continue to be sold in
209 California, we would like to propose that the minimum CRI be reduced from 82 to 80. While
210 there are products in the market at 82 CRI, this is because the manufacturer must target this
211 level to ensure that the minimum is 80. If the minimum target becomes 82, then the design
212 target becomes 85-86. There are few if any manufacturers that make LEDs with a CRI of 85,
213 thus 90 CRI becomes the next level.

214
215 If our proposal for an 80 CRI minimum is adopted, this will allow more efficient and cost
216 effective products to be sold in California. This also means that California consumers will have
217 access to the same less expensive and higher performing products as the rest of the country.
218 Most importantly, it will better allow the CEC to address the energy conservation needs of
219 California.

220
221 In addition to the change in CRI, we propose that the minimum requirement for R1 to R8 be
222 removed completely, allowing greater flexibility in LED design. If removing the minimum R1 to
223 R8 requirement is unacceptable to the Commission, then we suggest that the requirement on
224 R8 alone be changed to a minimum of 50.

225
226 We see strong adoption and sales of CRI 80 product in today’s market despite the availability of
227 both CRI 80 and 90 products. Given that greater than 79 million LED lamps were sold in the US
228 in 2014;¹⁰ the idea that we need to mandate high CRI lamps based on certain residential
229 applications is unfounded.

230

⁹ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, page 65.

¹⁰ US Environmental Protection Agency, *ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2014 Summary*,
http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2014_USD_Summary_Report.pdf

231 If the proposed language becomes the minimum requirement to sell LED lamps in the state,
232 California consumers will be forced to pay more for a high CRI product which is typically 15-20%
233 less efficient and 15-20% more expensive than lamps available to consumers in the other 49
234 states.¹¹

235
236 In addition to limits on R1 – R8 and CRI, the Commission has proposed limits on Duv, which is a
237 seldom used metric that describes how far the light source color is from the black body locus.
238 The proposal that appears in the 45 day language is as follows:

239
240
$$-0.0033 \leq \text{Duv} \leq 57700 \times (1/T)^2 - 44.6 \times (1/T) + 0.00854,$$

241
242 where T means the measured correlated color temperature.

243
244 At the public hearing, this was replaced with:

245
246
$$-0.0033 \leq \text{Duv} \leq 57700 \times (1/T)^2 - 44.6 \times (1/T) + 0.01184,$$

247
248 the difference being the quantity at the far right of the equation.

249
250 These are rather tight limits for any SSL lamp to meet.

251
252 As the Commission might be aware, in 2011 Philips Lighting was awarded the L-Prize by the
253 DOE for our design of an SSL 60W replacement lamp. This lamp is one of the most highly
254 designed and tested lamps in the history of lighting with extremely challenging performance
255 characteristics.

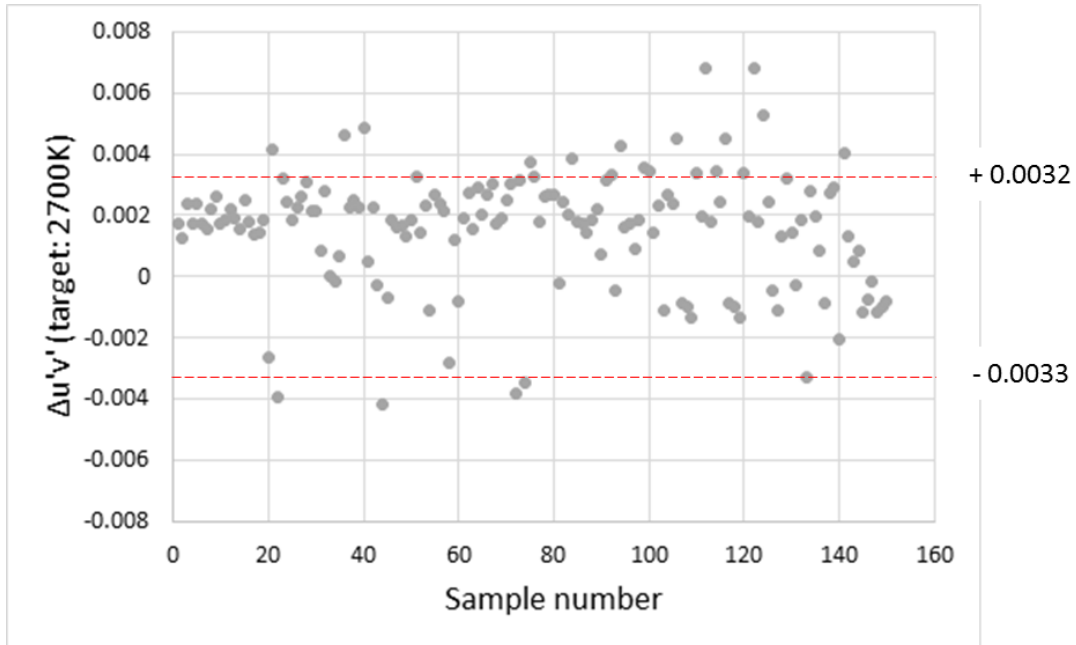
256
257 The following graph shows Duv data from 150 lamps sampled over 10 weeks of production for
258 the commercial version of the L Prize design. Superimposed on the data are the Duv limits from
259 the equation presented at the public hearing. These data show that not even this award
260 winning design will meet the Duv limits in the 45 day language.

261

¹¹ The staff report indicates that lamps which do not comply with the color requirements will likely need to add red to the spectral power distribution via red phosphors or red LEDs. The extra phosphor or LEDs make the product more expensive and introduce other technical problems. This expense will only be slightly mitigated by economy of scale due to increased demand/production. See Appendix to prior comments submitted by Philips to docket 14-AAER-1 on 11-14-2014.

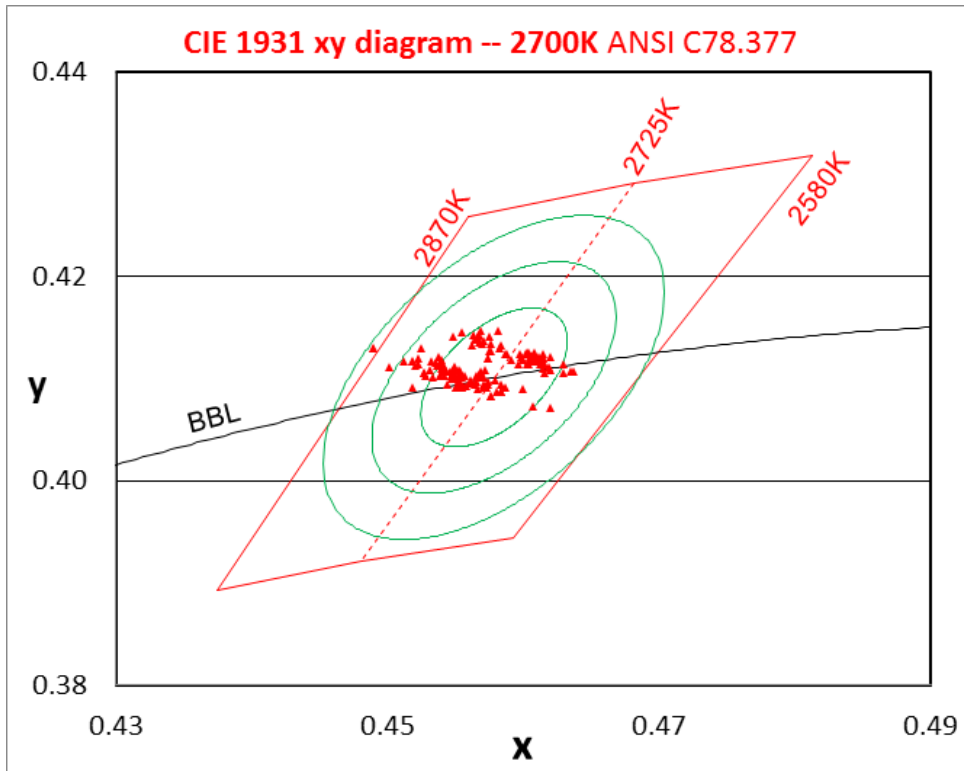
262
263

Duv Data from Production for L-Prize Design



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265
266
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268

These same data are replotted below with MacAdam ellipses of 3, 5, and 7 steps. All of the points are within 7 steps and 90% are within 4 steps.



269
270

271 Based on these data, from a product with an extremely tightly controlled design, we believe
272 that we have demonstrated that the proposed Duv limits are too restrictive. We recommend
273 instead that the Commission adopt ANSI 7-step quadrangles for the color limits.

274

275 **Product Efficiency**

276 As a means to greatly simplify the regulatory requirements, we suggest that product
277 performance be judged on CRI and efficacy only. The compliance score would be
278 changed/replaced as follows:

279

	Effective Date	Minimum CRI	Minimum Efficacy (LPW)
Tier 1	January 1, 2017	90	70
	January 1, 2017	80	80
Tier 2	January 1, 2019	90	80
	January 1, 2019	80	90

280

281 The Tier one proposal is now aligned with the proposed Energy Star Lamps v2.0 levels. It also
282 takes into account the lower efficacy of high CRI lamps.

283

284 **Oversights in the 45 Day Language**

285 There appear to be a few unintended consequences of the 45 day language which could be
286 characterized as serious oversights. These include lamps for emergency egress applications;
287 efficacy requirements for decorative lamps; efficacy limits and low wattage lamps, particularly
288 dimmable lamps; and connected lighting.

289

290 Small Diameter Halogen Directional Lamps and Emergency Egress Applications

291 The small diameter directional lamp requirements are sufficiently broad that they include
292 almost all existing halogen directional lamps. While this subject is covered broadly in the NEMA
293 documents, we wish to call the Commission’s attention to a potential life-safety issue with the
294 current language.

295

296 Philips Lighting’s Chloride brand manufactures emergency lighting units that use halogen MR
297 lamps of various wattages to provide emergency egress illumination during a power failure. A
298 copy of the product literature for one model that uses a 6V, 5.5W halogen MR16 lamp follows
299 at the end of our comments. NFPA 101¹² and local life-safety codes require that these units
300 provide a specific amount of footcandles over the egress pathway when in operation.

301

¹² National Fire Protection Association, *NFPA 101 – Life Safety Code 2015 Edition, sections 7.9.2.1 and 7.9.2.5*

302 The staff report examines the technological feasibility of small diameter directional LED lamps
303 from the standpoint of lumen output and beam angle.¹³ The critical lamp characteristic in
304 egress applications is not lumen output, but center beam candlepower (CBCP), and to a lesser
305 extent, beam angle. Furthermore, the staff report erroneously asserts that “One of the factors
306 that determine the beam intensity is the field angle, ...”.¹⁴ Thus giving the impression that
307 intensity and field angle are correlated. Field angle describes how far the beam spreads from
308 center, i.e., whether the beam is a spot or flood, but it does not correlate with absolute
309 intensity. Thus it is not a replacement for CBCP.

310
311 Another factor which the rulemaking does not appear to consider is that for a given model of
312 emergency egress equipment, each lamp type that is to be used with the equipment has to be
313 included in the safety listing (UL 924). In other words, even if a LED lamp matched the
314 photometric characteristics of the halogen lamp it replaces, it would still have to be evaluated
315 as part of the product safety approval for emergency egress equipment. There are a host of
316 other technical problems that could surface at this stage that could exclude the LED lamp from
317 consideration.

318 Given the above issues, we ask that the Commission move to exclude halogen lamps used in
319 life-safety equipment from the rulemaking. If they do not, halogen replacement lamps may not
320 be available in California for this critical life safety application.

321
322 We urge the Commission to support the NEMA comments which would change the scope of the
323 language to only cover 12V and 120V applications.

324
325 Efficacy Requirements - Decorative Lamps

326 Decorative LED lamps, especially those which are dimmable are inherently less efficient than
327 omnidirectional lamps and merit lower performance criteria.

328
329 The proposed efficacy requirement is 65 LPW. From the prior graphs, we see that 91% of the
330 existing Energy Star omnidirectional lamps meet this requirement, while only 63% of the
331 decorative lamps do. This demonstrates that decorative lamps are inherently less efficient than
332 omnidirectional product.

333
334 Digging into this further, we offer the following analysis of the data from the Energy Star
335 Certified Product List:

336
337

¹³ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, Figure 11, page 37; and Figure 14, page 42.

¹⁴ California Energy Commission, *Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode (LED) Lamp Efficiency Opportunities*, October 2015. CEC-400-2015-034, page 10.

338 **Comparison of Average Efficacies for Omnidirectional and Decorative Products**
 339 **Energy Star Certified Product List – October 21, 2015**
 340

CCT		Self-Ballasted LED Lamp Type		Efficacy Difference (LPW)
		Omnidirectional	Decorative	
All	# Certified Models	1634	705	
	Average LPW – All Models	81.6	73.0	8.6
	Average LPW - Top 25%	97.8	96.1	1.7
<hr/>				
CCT < 6500K	# Certified Models	1600	660	
	Average LPW – All Models	81.1	70.4	10.7
	Average LPW – Top 25%	96.3	87.6	8.7
<hr/>				
CCT ≥ 6500K	# Certified Models	34	45	
	Average LPW	106.7	111.5	-4.8
	Average LPW – Top 25%	124.5	118.8	5.7

341
 342 The above table shows the average efficacies for Energy Star omnidirectional and decorative
 343 lamps in several different ways. The first section shows the average LPW for all CCTs of a given
 344 type and then the average LPW of the top 25% most efficacious lamps. The next two sections
 345 are divided by CCT: less than 6500K and greater than or equal to 6500K.

346
 347 The average of all the models, regardless of CCT shows that decorative lamps have an efficacy
 348 about ~ 9 LPW lower than omnidirectional models. Lamps on the high end of the distribution
 349 show a much smaller spread in efficacy (~ 2 LPW) that can be explained by 6500K decorative
 350 lamps that have very high efficacies. When these are taken out of the dataset, the remaining
 351 lamps (< 6500K) show a very clear difference of 9-11 LPW between decorative and
 352 omnidirectional products.

353
 354 For this reason, decorative lamps merit slightly lower performance criteria to increase product
 355 availability. If not, the use of decorative halogen and CFL products will continue. We suggest
 356 that the efficacy requirements for decorative lamps be reduced by 10 LPW from their
 357 omnidirectional counterparts in Tier 1 and Tier 2.

358
 359 Low Wattage LED Lamps

360 Low wattage LED lamps are those typically intended as a replacement for incandescent lamps
 361 rated 25W or lower, and that have a rated input power of less than 4W. These products,
 362 particularly dimmable versions, are less efficient than their higher wattage counterparts.
 363 These lamps will be excluded from sale in California unless the 45 day language is modified.

364

365 A simple solution to this issue would be to increase the minimum lumen requirement for lamps
366 to be regulated from 150 lumens to 310 lumens. This is consistent with the 40W equivalency
367 level proposed in Table K-15.

368

369 Connected Lighting

370

371 *A. Standby Power*

372 Others have eloquently commented on the need for an increase in the proposed limit of
373 0.2W for standby power,¹⁵ even with a January 2019 implementation date, so our
374 comments will be brief.

375

376 Connected lighting is in its infancy and not even industry, much less the Commission, can
377 foresee its potential. Current applications include remote control, color changing, and
378 Wi-Fi. On the horizon is Li-Fi.¹⁶ As such, it is premature to set a standby power limit as
379 restrictive as 0.2W. Such a limit will hamper innovation and limit non-lighting features
380 which can be incorporated into future products.

381

382 We urge the Commission to support the NEMA standby power proposal of 1.0 watt and
383 revisit a lower value in a future rulemaking if technologically feasible.

384

385 *B. Efficacy*

386 Connected lamps have inherently lower efficacy than their non-connected counterparts.
387 Additional power is used for microprocessor control and RF components. Tunable and color
388 changing lamps use some lower efficacy LEDs (e.g. 2200K white LEDs or RGB LEDs), and
389 require extra optics to mix the light from the different LED colors. The net result is efficacy
390 about 10 LPW lower than a non-connected equivalent. Efficacy limits higher than 70 LPW
391 for connected omnidirectional lamps will severely limit product options. Thus we propose
392 the following efficacy limits for omnidirectional lamps:

393

		Non-Connected Products	Connected Products
Effective Date	Minimum CRI	Minimum Efficacy (LPW)	Minimum Efficacy (LPW)
January 1, 2017	90	70	60
January 1, 2017	80	80	70
January 1, 2019	90	80	70
January 1, 2019	80	90	80

394

395 There are few non-omnidirectional connected lamps available at this time, thus it is difficult to
396 make efficacy recommendations for those products now.

¹⁵ Docket 15-AAER-06, California Energy Commission, Stack Labs Comments on Amending the Appliance Efficiency Regulations, November 30, 2015. http://docketpublic.energy.ca.gov/PublicDocuments/15-AAER-06/TN206800_20151130T165613_Kent_Whiting_Comments_Stack_Labs_Comments.pdf

¹⁶ Bariso, J “Meet Li-Fi, the Breakthrough Technology That's 100 Times Faster Than Wi-Fi”, inc.com, December 1, 2015. <http://www.inc.com/justin-bariso/meet-li-fi-the-breakthrough-technology-thats-100-times-faster-than-wi-fi.html>

397 **Miscellaneous Issues**

398 There are a few miscellaneous issues that need to be addressed in the language. They are
399 presented along with recommendations for their resolution.

400

401 Section 1607 – Table K-15

402 Table K-15 describes incandescent equivalencies for state regulated LED lamps. Within the
403 table itself is a restriction that the table applies to omnidirectional lamps with E26 and GU24
404 bases.

405

406 We suggest that it would be clearer if the restrictive language was moved outside the table
407 (underlined text is new):

408

409 *1607 Marking of Lamps.*

410 *(12)(B)(iv) Claims of incandescent wattage equivalence for omnidirectional lamps with*

411 *E26 or GU-24 bases shall have ...*

412

413 Consequently, the second row of Table K-15 would be deleted.

414

415 Section 1607(12)(C)

416 As written, this section suggests that the lamp itself should be labeled “for decorative
417 purposes”. The Commission may be not be aware, but the surface area available for printing on
418 these low lumen lamps is minimal. Thus it is difficult to place additional text on the lamp. We
419 suggest the following modification (underlined text is new):

420

421 *(C) The packaging of a lamp that is certified with a light output of less than 150 lumens*
422 *for candelabra bases, or less than 200 lumens for other bases, shall be labeled as “for*
423 *decorative purposes.”*

424

425 Section 1607(12)(D)

426 The proposed text states that “Lamps shall certify ...”. It is not technologically feasible at this
427 time for lamps to self-certify to the Commission. We suggest that this be changed to
428 “Manufacturers shall certify ...”

429

430 Section 1605.3(C)(vi)

431 The 45 day language requires that the light distribution requirements follow those in the Energy
432 Star version 1.1 specification. We note that Energy Star has just issued the Final Draft of the
433 Lamps v2.0 Specification. In this final draft, they propose to relax some of the omnidirectional
434 distribution requirements. We recommend that the Commission harmonize with Energy Star in
435 this regard and modify the language in this section to refer to the Energy Star Lamps Version
436 2.0 specification.

437

438 Alternate Certification Path

439 We request that the CEC allow that lamps which meet the final Title 20 requirements and meet
440 the Energy Star criteria can be certified using the same data that were used for Energy Star
441 certification. The point of this request is to avoid duplicate testing for life and lumen
442 maintenance.

MAJOR RECOMMENDATIONS

443
444
445 As indicated in our comments, we offer seven major recommendations to the Commission.
446

Light Source Color – R1 to R8

448 Remove the minimum requirement of 72 on the individual color indices of R1 to R8.

449
450 There is no technical basis for including them as a requirement and they conflict with the
451 minimum proposed CRI requirement.

452
453 If removing the minimum R1 to R8 requirement is unacceptable to the Commission, then we
454 suggest that the requirement on R8 alone be changed to a minimum of 50.

455

Light Source Color – CRI

456 Reduce the CRI requirement from 82 to 80 for state regulated LED lamps.

457
458
459 This change will allow lamps designed to CRI 80 to meet the requirement, and align with
460 common industry practice and the Energy Star program.

461

Small Diameter Directional Lamps – CRI

462 Set a minimum CRI of 80 for small diameter directional lamps.

463

464
465 There is currently no minimum requirement for these products and adding one will not reduce
466 product availability.

467

Efficacy Limits - Decorative Lamps

468
469 As shown in our earlier comments, decorative lamps have an efficacy about 10 LPW lower than
470 omnidirectional lamps. Thus we propose that the efficacy requirements for decorative lamps
471 be reduced by 10 LPW from their omnidirectional counterparts in Tier 1 and Tier 2.

472

Efficacy Limits - Connected Lamps

473
474 Connected lamps have inherently lower efficacy than their non-connected counterparts. Thus
475 we propose that the efficacy limits for connected omnidirectional lamps be 10 LPW less than
476 those of their non-connected counterparts.

477

Efficacy Limits - General

478
479 In order to simplify the regulatory requirements, in lieu of a compliance equation, we suggest
480 that product performance be judged on CRI and efficacy instead. The Tier 1 levels would align
481 with the proposed Energy Star Lamps v2.0 levels and take into account the lower efficacies of
482 high CRI lamps.

483

484

485

486 **Minimum Lumen Level**

487 In our comments, we mentioned that low wattage decorative LED lamps will not meet the
488 minimum compliance score even with the adjustment proposed above. Thus we propose that
489 the minimum lumen output required before a product falls within the scope of the regulation
490 be 310 lumens. This is consistent with the 40W equivalency level proposed in Table K-15. This
491 is a simple solution that keeps low wattage decorative LED lamps on the California market.

492

493 Thus, section 1605.3(C) would be changed as follows:

494

495 *(C) State-regulated LED lamps with lumen output of 310 lumens or greater and*
496 *manufactured on or after January 1, 2017 shall have:*

497

APPENDIX A

R1 to R8 Data for Self-Ballasted Philips LED Lamps

Shaded cells represent indices with a value less than 72

Model	R1	R2	R3	R4	R5	R6	R7	R8	CRI
A	80	91	96	79	80	89	82	58	82
B	79	90	97	78	79	87	82	57	81
C	79	89	97	79	79	87	82	58	81
D	79	90	97	79	79	87	82	58	81
E	80	91	96	79	80	89	82	58	82
F	80	90	96	79	80	88	82	58	82
G	80	91	96	80	81	90	82	58	82
H	80	90	97	80	80	88	83	58	82
I	80	88	95	81	80	84	85	62	82
J	81	90	97	80	81	89	82	59	82
K	79	91	96	77	79	88	83	59	81
L	79	90	96	77	79	87	84	61	82
M	79	91	96	77	79	88	83	59	82
N	80	91	95	77	80	89	82	57	81
O	79	90	96	76	78	86	82	58	81
P	78	89	96	76	77	85	83	59	80
Q	79	88	97	79	78	85	84	60	81
R	79	89	96	79	79	88	80	54	81
S	82	91	97	81	82	88	85	65	84
T	84	92	96	82	83	88	88	70	85
U	93	96	97	92	93	95	93	84	93
V	93	95	96	92	92	94	93	84	92

505

506

507 END COMMENTS

Architectural Emergency

SV16 Series
Polycarbonate, Wet
Location Emergency Unit



Specifier's Reference

Project
Type
Model No.
Comments

codes and standards

- UL 924 listed
- UL damp location listed
- UL wet location listing optional
- NFPA 101, NEC, IBC, BOCA, and OSHA illumination standard
- Meets ADA specifications for wall mounted lighting fixtures

construction

- The high-abuse housing and backplate are molded from high-impact, F1 rated, GE Lexan polycarbonate.
- All injection molded components meet the UL 94 V-0, 5 VA flame retardant standard for emergency lighting products.
- All units are supplied standard with a UL damp location listing and tamperproof screw kit.
- Optional wet location listed products include a fully gasketed cover.
- Standard non-tamperproof screws are also included with the product.

installation

- Installation is simplified by the use of a snap-together backplate and housing.
- When installed with the supplied tamperproof screw kit, removal from mounting surface, or removal of outer protective cover is not possible under normal service conditions without the use of a torx T-15 bit.
- Utility supply is completed by use of a modular plug-in wiring harness.
- A convenient knockout is also made available in the top right section of product to accommodate 1/2" conduit (damp location listed units only).
- Wet location units may be mounted to standard 3-1/2" and 4" octagonal junction boxes.
- Damp location units may be junction box or rigid conduit mounted.

electronics

- 120/277 VAC dual voltage input with surge protected, solid state, fully automatic, voltage regulated charger.
- Charging system is complete with low voltage disconnect, AC lockout, brownout protection and combination indicator lamp and illuminated test switch.
- All circuit board components are coated with a moisture-resistant protector.
- Power Consumption
120 VAC - 0.05 A, 0.30 A with heater option.
277 VAC - 0.02 A, 0.13 A with heater option.
- Damp location: 50°F (10°C) to 104°F (40°C).
- Wet location: 41°F (5°C) to 104°F (40°C).
- Wet location with heater: -4°F (-20°C) to 104°F (40°C).

lamps

- Illumination is provided by two high performance 6 VDC, 5.5 W MR16-style halogen lamps.
- Lamps are held in an attractive molded swivel assembly, and are fully adjustable.

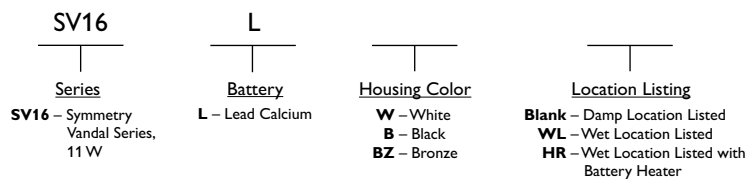
battery

- Maintenance free sealed lead calcium with 5 year life.
- Provides a minimum of 90 minutes emergency illumination.

warranty

- Three year full warranty on electronics and unit (excluding lamps).

Green Product Choice: SV16LW



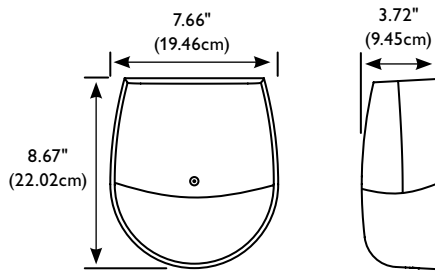
Accessories (Order Separately)

T15TPTOOL – Tamperproof Tool

options

- HR – UL wet location listed with a battery heater and suitable for use in temperatures ranging from -4°F to 104°F.
- WL – UL wet location listed for use in temperatures ranging from 41°F to 104°F.

dimensions



performance

Meets Life Safety Code illumination standard; average of 1.0 FC, no point less than 0.1 FC, max to min ratio of 40:1. Assumes open space with no obstructions, mounting height: 8' and reflectances: 80/50/20. Analysis based on independently tested photometrics.

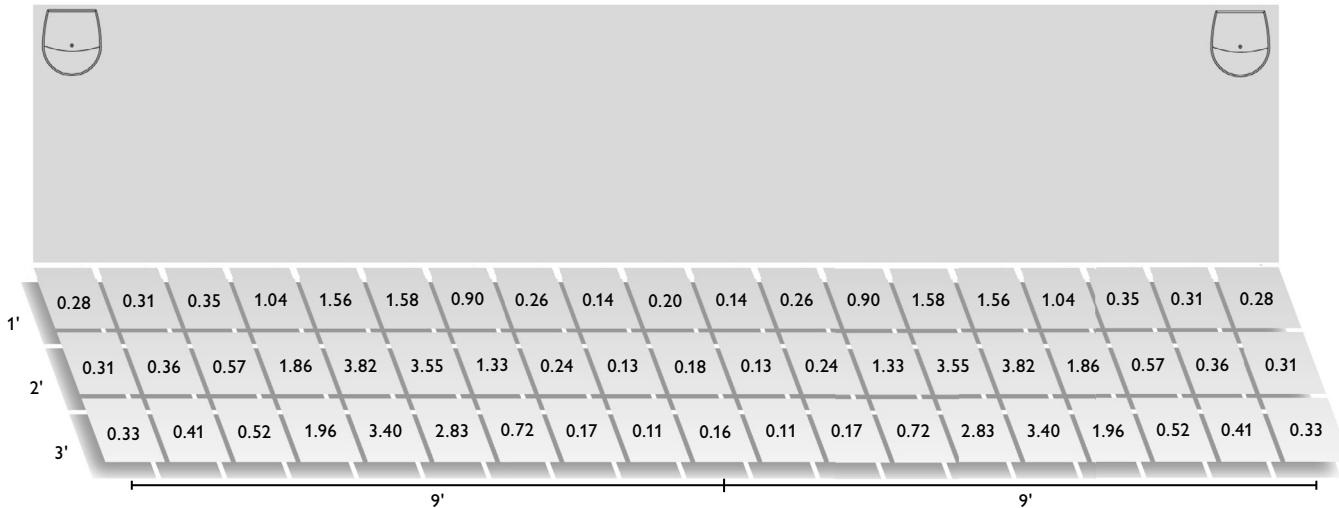


Chart represents (2) luminaires mounted on 18' centers, mounting height 8' AFF

Test No.: ITL55238

Average initial footcandles at floor = 1.03
Maximum initial footcandles at floor = 3.82

Minimum initial footcandles at floor = 0.28
Maximum to minimum ratio = 13.7:1

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