

Lamps Verification Testing: Marginal Failure

NOTE: Tests that do not appear in the table below do not have marginal failure allowances, see specification for passing requirement. 1/27/2015

Test/Requirement	Passing Criteria	Marginal Failure	Full Failure
Efficacy	Reported value (average) and 8 or more individual units out of 10 are \geq required efficacy. A 3% tolerance may be applied to the measured initial luminous flux value of each unit (e.g. [initial luminous flux of a unit X 1.03]) prior to the calculation of efficacy for the unit if the average of all measured lamps fails to meet the requirement without the tolerance	Measured average value and 8 or more unit values efficacy does not meet passing criteria after 3% tolerance is applied and is $\leq 6\%$ below required efficacy.	Measured average value and/or at least 3 lamps individually fail to meet efficacy $> 6\%$
Light Output	Reported value (average) and 8 or more individual units out of 10 shall fall within the range of lumens specified. A 3% tolerance may be applied to the measured initial luminous flux value of each unit (e.g. [initial luminous flux of a unit X 1.03]) prior to the calculation of efficacy for the unit if the average of all measured lamps fails to meet the requirement without the tolerance	Measured average value and 8 or more unit values light output does not meet passing criteria after 3% tolerance is applied and is $\leq 6\%$ below required light output for the equivalency claim made at the time of certification.	Measured value and at least 3 lamps or more units light output is $> 6\%$ below required light output for the equivalency claim made at the time of certification.
Elevated Temperature Light Output Ratio	One unit shall maintain $\geq 90\%$ of initial light output. (Directional lamps only)	$85\% \leq$ Light Output $< 90\%$	$< 85\%$
Center Beam Intensity	One unit shall be greater than or equal to the center beam intensity value calculated by the benchmark tool. (MR and PAR lamps only)	Measured value is $\leq 6\%$ below the value calculated by the benchmark tool.	Measured value is more than 6% below the value calculated by the benchmark tool.
Luminous Intensity Distribution Omnidirectional LED	90% of the luminous intensity measured values (candelas) shall vary by no more than 25% from the average of all measured values. All measured values (candelas) shall vary by no more than 50% from the average of all measured values. And $\geq 5\%$ of total flux (lumens) must appear in the 135-180 zone.	$\leq 85\%$ of the luminous intensity measured values vary by no more than 25% from the average of all measured values. Must comply with other requirements.	Less than 5% of total flux (zonal lumens) emitted in the 135° to 180° zone and/or $> 85\%$ of the luminous intensity measured values vary by more than 25% from the average of all measured values.
Correlated Color Temperature	9 out of 10 units shall fall within a 7-step MacAdam ellipse or ANSI quadrangle for the designated CCT.	2 samples fall outside the 7 steps	3 samples fall outside the 7 steps
Color Rendering Ra	Lamp shall have a color rendering index (Ra) ≥ 80 . The average of units tested shall meet the requirements and no more than 3 units shall have Ra < 77 . No unit shall have Ra < 75 .	Average up to 3 CRI points below requirement, or 4 units fall below 77 but average is at least 80.	Average is ≤ 76 , or 5 units fall below 77, or any unit has CRI < 75
Color Rendering R9	Solid State lamps shall have an R9 > 0 .	$-4 \leq R9 \leq 0$	R9 < -4
Color Maintenance	Average of 10 lamps within a total distance of 0.007 on the CIE 1976	0.007 – 0.0075 average	> 0.0075

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	u'v' diagram. Nine or more units shall meet the requirement.	and/or 2 samples fail to meet requirement																			
Color Angular Uniformity	Variation of chromaticity across the beam angle of the lamp shall be within a total distance of 0.006 from the weighted average point on the CIE 1976 (u'v') diagram.	0.006 – 0.007	> 0.007																		
Lumen Maintenance (CFL)	Lamp shall maintain $\geq 90\%$ of initial lumen output at 1000-hours. The reported value shall be the average lumen maintenance of 10 units. All units shall be surviving at 1000-hours.	>3% to $\leq 6\%$	the reported value fails >6% and/or 1 sample fails to operate																		
Lumen Maintenance (LED) at 3,000 hours	Lamp average lumen maintenance of the 10 units shall meet the minimum percentages of 0-hour light output corresponding to the lamp's life claim per the table. <table border="1"> <thead> <tr> <th>Maximum Life Claim (hours to L₇₀)</th> <th>Minimum Lumen Maintenance After 3,000 Hours</th> </tr> </thead> <tbody> <tr> <td>15,000</td> <td>93.1%</td> </tr> <tr> <td>20,000</td> <td>94.8%</td> </tr> <tr> <td>25,000</td> <td>95.8%</td> </tr> </tbody> </table>	Maximum Life Claim (hours to L ₇₀)	Minimum Lumen Maintenance After 3,000 Hours	15,000	93.1%	20,000	94.8%	25,000	95.8%	Measured average value does not meet passing criteria after 3% tolerance is applied and is $\leq 6\%$ below required lumen maintenance level.	Measured average value fails to meet lumen maintenance >6% and/or 1 unit fails to operate at 3,000 hours.										
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Lumen Maintenance (LED) at 6,000 hours	Lamp shall maintain minimum percentage of 0-hour light output after completion of the 6000-hr test duration per the table. The reported values shall be the average lumen maintenance of ≥ 9 surviving units and shall meet the minimum requirement for the designated life claim. Note for verification testing, passing will be based on whether a lamp meets the minimum lumen maintenance and rated life requirement in the specification, e.g. 15,000 hours or 25,000 hours. <table border="1"> <thead> <tr> <th>Maximum Life Claim (hours to L₇₀)</th> <th>Minimum Lumen Maintenance After Test Duration</th> </tr> </thead> <tbody> <tr> <td>15,000</td> <td>86.7%</td> </tr> <tr> <td>20,000</td> <td>89.9%</td> </tr> <tr> <td>25,000</td> <td>91.8%</td> </tr> <tr> <td>30,000</td> <td>93.1%</td> </tr> <tr> <td>35,000</td> <td>94.1%</td> </tr> <tr> <td>40,000</td> <td>94.8%</td> </tr> <tr> <td>45,000</td> <td>95.4%</td> </tr> <tr> <td>50,000</td> <td>95.8%</td> </tr> </tbody> </table>	Maximum Life Claim (hours to L ₇₀)	Minimum Lumen Maintenance After Test Duration	15,000	86.7%	20,000	89.9%	25,000	91.8%	30,000	93.1%	35,000	94.1%	40,000	94.8%	45,000	95.4%	50,000	95.8%	Measured average value does not meet passing criteria after 3% tolerance is applied and is $\leq 6\%$ below required lumen maintenance level.	Measured average value fails to meet lumen maintenance >6% and/or 2 units fail to operate at 6,000 hours.
Maximum Life Claim (hours to L ₇₀)	Minimum Lumen Maintenance After Test Duration																				
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Rated Life (CFL)	Lamp shall have a rated life $\geq 10,000$ hours. At 40% of rated life 90% of the tested units shall be operational.	Up to 2 units fail to operate at 4,000 hours	3 units fail to operate at 4,000 hours																		
Rapid Cycle	At least 5 out of 6 units shall survive the minimum number of cycles.	2 units fail to survive	3 units fail to survive																		
Power Factor	The average of 10 lamp models shall have a power factor greater than or equal to a minimum limit.	$\leq 5\%$ below (CFL 0.475 LED 0.665)	>5%																		
Start Time	The average of 3 units must remain continuously illuminated within one second of application of electrical power.	>1000 and ≤ 1500 milliseconds	>1500 milliseconds																		
Run Up Time	The average of 10 units shall achieve 80% stabilized light output within the defined time period. Bare lamps ≤ 60 seconds. Covered lamps ≤ 120 seconds.	If unit with longest run-up time is excluded, and the average of the remaining 9 units is \leq the requirement.	Average of 9 best performing units fails to meet requirement.																		
Transient Protection	All units, 5, shall be fully operational at the completion of testing.	1 unit fails	2 units fail																		