specialty
lighting industries

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LM-80 and TM-21 information
For sources CZ14, CZ20 and CZ28

Specialty Lighting Industries and Graffiti Lighting only use light sources from the top vendors in the industry. While we are always on the hunt for a better source, we will never produce a product without assuring the LED source has been tested to industry standard protocols.

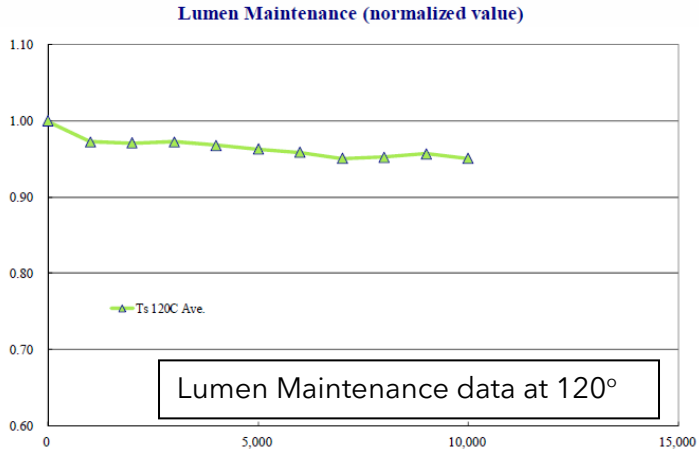
IES LM-80 is a test method to collect lumen and color maintenance data. IES TM-21 is the industry accepted calculation to extrapolate LM-80 data for determining lumen degradation over extended time. 6000 hours of testing is required to make predictions to 35,000 hours and 10,000 hours are required to extrapolate degradation to 55,000 hours. All data below is based on 10,000 hours of LM-80 testing and calculated from the US DoE Energy Star Calculator.

Thermal considerations are an important factor in determining lumen maintenance. We design our fixtures to maintain a LED case temperature (Tc) below 105° C (221° F) at 40° C (104° F) ambient temperature. The data shown below is with a Tc of 120° C (248° F), allowing for some thermal headroom.

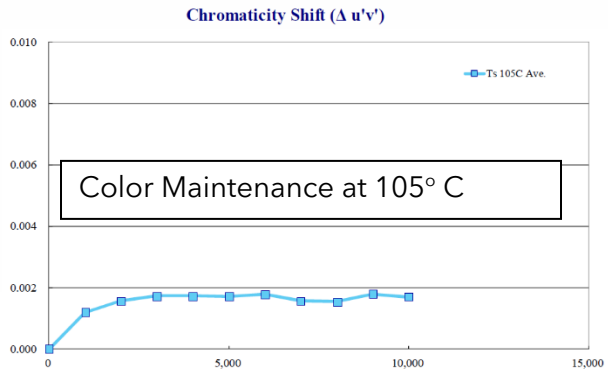
The full LM-80 reports and TM-21 Calculator are available upon request, but we have boiled down the test reports for quick reference and specification inclusion.

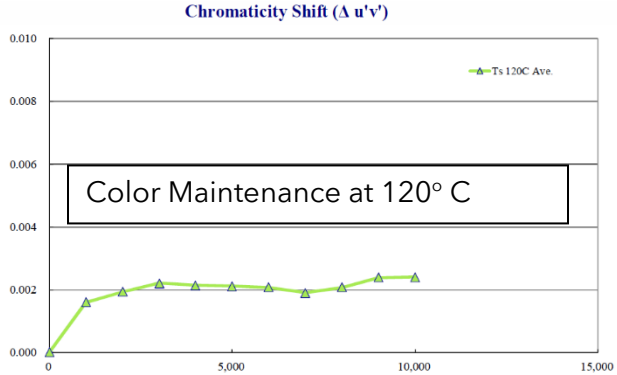
Lifetime: L87 <55,000 hours – Based on TM-21, we will maintain 87% of our lumens for at least 55k hours

Statistical Significance: **B97** – Many manufacturers publish "B50" meaning 50% of their fixtures will achieve their rated lumen maintenance and 50% will NOT. Specialty achieves a "B" value of 97 meaning 97% of our parts will meet the lifetime claim.



Color Maintenance - ~2 Delta u'v' – 1 "point" in u'v' is approximately equivalent to a MacAdam ellipse step. The 105° C data shows the sources stabilizing just a little under 2 u'v' while the 120° C data shows just a little above the 2 u'v'. Because color can move in both X and Y there is no method for extrapolating this data to 50k hours. The best we can do is provide the data from the test hours.





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Finally, below is our TM-21report information. All 3 test temperatures are shown below. The TM-21 excel calculator can be provided upon request from you regional sales manager.

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	CLU048-1818C4-273H5M3-F1				
Test Condition 1 - 55ºC Case Temp		**Test Condition 2 - 105ºC Case Temp**		**Test Condition 3 - 120ºC Case Temp**	
Sample size	11	Sample size	11	Sample size	11
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	4140	DUT drive current used in the test (mA)	4140	DUT drive current used in the test (mA)	4140
Test duration (hours)	10,000	Test duration (hours)	10,000	Test duration (hours)	10,000
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	5,000 - 10,000
Tested case temperature (ºC)	55	Tested case temperature (ºC)	105	Tested case temperature (ºC)	120
α	-1.094E-06	α	1.049E-06	α	1.971E-06
B	0.970	B	0.973	B	0.970
Reported L87(10k) (hours)	(99,000)	Reported L87(10k) (hours)	>55000	Reported L87(10k) (hours)	>55000

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (ºC)	120.00
$T_{s,1}$ (K)	393.15
α_1	1.971E-06
B_1	0.970
$T_{s,2}$ (ºC)	-
$T_{s,2}$ (K)	-
α_2	-
B_2	-
E_a/k_b	-
A	-
B_0	0.970
$T_{s,i}$ (ºC)	120.00
$T_{s,i}$ (K)	393.15
α_i	1.971E-06
Reported L87(10k) at 120ºC (hours)	>55000