ENERGY STAR® TM-21 Calculator

Note: Users should download a new copy of this calculator for each use, to ensure use of the most up-to-date version of the calculator. Users are encouraged to bookmark the hyperlink to this calculator. Project-specific copies complete with calculations may be saved on a local drive.

This calculator is based on the Illuminating Engineering Society's TM-21-11: *Projecting Long Term Lumen Maintenance of LED Light Sources* and *Addendum A for TM-21-11: Projecting Long Term Lumen Maintenance of LED Packages*. Calculator results have been reviewed by the U.S. National Institute of Standards and Technology (NIST). Calculations are locked; only data entry cells may be modified.

Calculator inputs are entered on the second tab, with instructions. The calculator may be used with one, two or three case temperatures. Inputting values on the second tab generates a complete TM-21 report on the Report tab.

For calculating data with different test period lengths, use data from the time period equal to the shortest time period for all temperatures.

Questions may be directed to lighting@energystar.gov

TM-21 Inputs

Instructions
Yellow fields are completed by the user. Fields not used should be left blank. Cyan fields are calculated based on user entries. First, enter a description of the LED light source tested. Then complete the fields labeled "LM-80 Testing Details". Test duration must be at least 6,000 hours. If only one case temperature data set is to be used (no interpolation), complete only "Tested case temperature 1". For only two case temperature data sets, complete 1 and 2. Next, further to the right, in the corresponding box(es) for each tested case temperature, enter the test data along with the time (in hours) at which each measurement was taken. Data entered must be normalized then averaged measured data (per TM-21 sections 5.2.1 and 5.2.2). If case temperatures have different test durations, enter data up to the lowest of the test durations for all of the case temperatures. Enter drive current, *in-situ* temperature data and the percentage of initial lumens to project to in the fields labeled "*In-Situ* Inputs". Results can be tailored to estimate lumen maintenance at a specific time by entering a value (t) in the yellow field. A complete TM-21 report will appear on the next tab labeled "Report".

LM-80 Test Inputs

Description of LED Light Source Tested (manufacturer, model, catalog number)
RALED II PLUS 48 LED 145W (Se evalua en ta de 25°C) UHE Y DA-UHE LM-80-15 OSCONIQ S 5050 GTG REPORT ANSI/IES LM-80-20 800mA 17000H Test Report.N01A240811172L00101, COD. LAB: 26-0340, Corriente Driver:949.6mA, Cada Modulo:949.6mA, Corriente LED:474.8mA

LM-80 Testing Details	
Total number of units tested per case temperature:	25
Number of failures:	0
Number of units measured:	25
Test duration (hours):	17000
Tested drive current (mA):	800
Tested case temperature 1 (T_c, ºC):	55
Tested case temperature 2 (T_c, ºC):	85
Tested case temperature 3 (T_c, ºC):	105

Test Data for 55ºC Case Temperature		Test Data for 85ºC Case Temperature		Test Data for 105ºC Case Temperature	
Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)	Time (hours)	Lumen Maintenance (%)
1000	100.16%	1000	100.07%	1000	99.91%
2000	100.01%	2000	99.92%	2000	99.72%
3000	99.87%	3000	99.72%	3000	99.52%
4000	99.69%	4000	99.52%	4000	99.31%
5000	99.50%	5000	99.32%	5000	99.09%
6000	99.32%	6000	99.13%	6000	98.87%
7000	99.20%	7000	98.98%	7000	98.68%
8000	99.06%	8000	98.84%	8000	98.49%
9000	98.94%	9000	98.70%	9000	98.30%
10000	98.83%	10000	98.56%	10000	98.10%
11000	98.75%	11000	98.47%	11000	97.94%
12000	98.64%	12000	98.38%	12000	97.76%
13000	98.55%	13000	98.29%	13000	97.57%
14000	98.46%	14000	98.20%	14000	97.39%
15000	98.37%	15000	98.12%	15000	97.24%
16000	98.31%	16000	98.06%	16000	97.10%
17000	98.25%	17000	97.98%	17000	96.99%

In-Situ Inputs

Drive current for each LED package/array/module (mA):	474.8
In-situ case temperature (T_c, ºC):	64.83
Percentage of initial lumens to project to (e.g. for L_{70}, enter 70):	80

Results

Time (t) at which to estimate lumen maintenance (hours):	100,000
Lumen maintenance at time (t) (%):	90.81%
Reported L80 (hours):	>102000

Calculations: 3

Minimum Case Temperature ($T_{s,1}$) for Extrapolation (K):	328.15
α_1	0.0000
B_1	0.9976
Maximum Case Temperature ($T_{s,2}$) for Extrapolation (K):	358.15
α_2	0.0000
B_2	0.9953
E_a/k_b	103.01
k_b (eV/K)	8.6173E-05
E_a (eV)	8.8765E-03
A	0.0000
B_0	0.9964
In Situ Case Temperature ($T_{s,i}$) (K):	337.98
α_i	0.0000
Reported L80 (hrs):	>102000

Table 1: Report at each LM-80 Test Condition					
Case Temperature 1		Case Temperature 2		Case Temperature 3	
Temperature (°C):	55	Temperature (°C):	85	Temperature (°C):	105
Temperature (°K):	328.15	Temperature (°K):	358.15	Temperature (°K):	378.15
α:	9.19E-07	α:	9.44E-07	α:	1.74E-06
B:	1.00	B:	1.00	B:	1.00
Reported L80 (hrs):	>102000	Reported L80 (hrs):	>102000	Reported L80 (hrs):	>102000

Table 2: Report for Interpolation (based on in-situ temperature)

$T_{s,1}$ (^oC)	55.00
$T_{s,1}$ (K)	328.15
α_1	9.1922E-07
B_1	0.9976
$T_{s,2}$ (^oC)	85.00
$T_{s,2}$ (K)	358.15
α_2	9.4371E-07
B_2	0.9953
E_a/k_b	1.03E+02
A	0.0000
B_0	0.9964
$T_{s,i}$ (^oC)	64.83
$T_{s,i}$ (K)	337.98
α_i	9.2765E-07

TM-21 Report

Table 1: Report at each LM-80 Test Condition	
Description of LED Light Source Tested (manufacturer, model, catalog number)	RALED II PLUS 48 LED 145W (Se evalua en ta de 25°C) UHE Y DA-UHE LM-80-15 OSCONIQ S 5050 GTG REPORT ANSI/IES LM-80-20 800mA 17000H Test Report.N01A240811172L00101, COD. LAB: 26-0340, Corriente Driver:949.6mA, Cada Modulo:949.6mA, Corriente LED:474.8mA

Test Condition 1 - 55ºC Case Temp	
Sample size	25
Number of failures	0
DUT drive current used in the test (mA)	800
Test duration (hours)	17,000
Test duration used for projection (hour to hour)	8,000 - 17,000
Tested case temperature (ºC)	55
α	9.192E-07
B	0.998
Reported L80(17k) (hours)	>102000

Test Condition 2 - 85ºC Case Temp	
Sample size	25
Number of failures	0
DUT drive current used in the test (mA)	800
Test duration (hours)	17,000
Test duration used for projection (hour to hour)	8,000 - 17,000
Tested case temperature (ºC)	85
α	9.437E-07
B	0.995
Reported L80(17k) (hours)	>102000

Test Condition 3 - 105ºC Case Temp	
Sample size	25
Number of failures	0
DUT drive current used in the test (mA)	800
Test duration (hours)	17,000
Test duration used for projection (hour to hour)	8,000 - 17,000
Tested case temperature (ºC)	105
α	1.739E-06
B	0.998
Reported L80(17k) (hours)	>102000

Table 2: Interpolation Report (projection based on *in-situ* temperature entered)	
$T_{s,1}$ (ºC)	55.00
$T_{s,1}$ (K)	328.15
α_1	9.192E-07
B_1	0.998
$T_{s,2}$ (ºC)	85.00
$T_{s,2}$ (K)	358.15
α_2	9.437E-07
B_2	0.995
E_a/k_b	1.03E+02
A	1.258E-06
B_0	0.996
$T_{s,i}$ (ºC)	64.83
$T_{s,i}$ (K)	337.98
α_i	9.277E-07
Reported L80(17k) at 64.83ºC (hours)	>102000

Report Generated By: Diego Armando Palacios	Notes: Lumen maintenance is above 80% @100000 prediction (=90.81%) B10 de acuerdo con la ficha técnica del módulo Fortimo Fast Flex 2x8 DA-UHE (adjunta).
Company: Roy Alpha	
Date:2026/06/23	