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Report No. 103899309CRT-001

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Standards
International Civil Aviation Organization (ICAO), Aerodromes, Annex 14, Volume 1, Eighth Edition, dated July 2018

Test Purpose	Performance testing of a Medium Intensity Obstacle Light
Test Dates	April 8th, 2019 through May 16th, 2019

Rudolph Sporman
Engineer, Team Lead
Lighting

Christopher Metcalf
Engineering Supervisor
Lighting

Test Plan and Datasheets			
Client	Shanghai Nanhua Electronics Co., Ltd.	Engineer	Rudolph Sporman
Report #	103899309CRT-001	Reviewer	Christopher Metcalf
Product	Obstacle Light	Model(s)	LM101
Standard	ICAO Annex 14, dated July 2018		

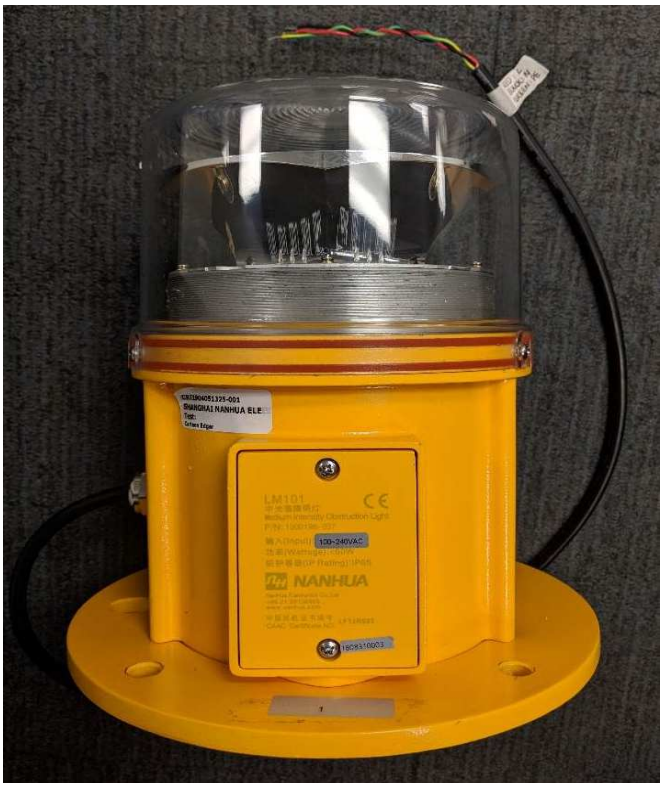
Spec	Test name	Clause	Pass Fail NA
ICAO	Photometry Medium Intensity Type A (White)	Table 6-3W	NA
ICAO	Photometry Medium Intensity Type B (Red)	Table 6-3R	Pass
ICAO	Chromaticity ICAO App. 1	2.3.1	Pass
ICAO	Photometry High Intensity Type A	Table 6-3A	NA
ICAO	Photometry High Intensity Type B	Table 6-3B	NA
ICAO	Chromaticity ICAO App. 1	2.3.1H	NA

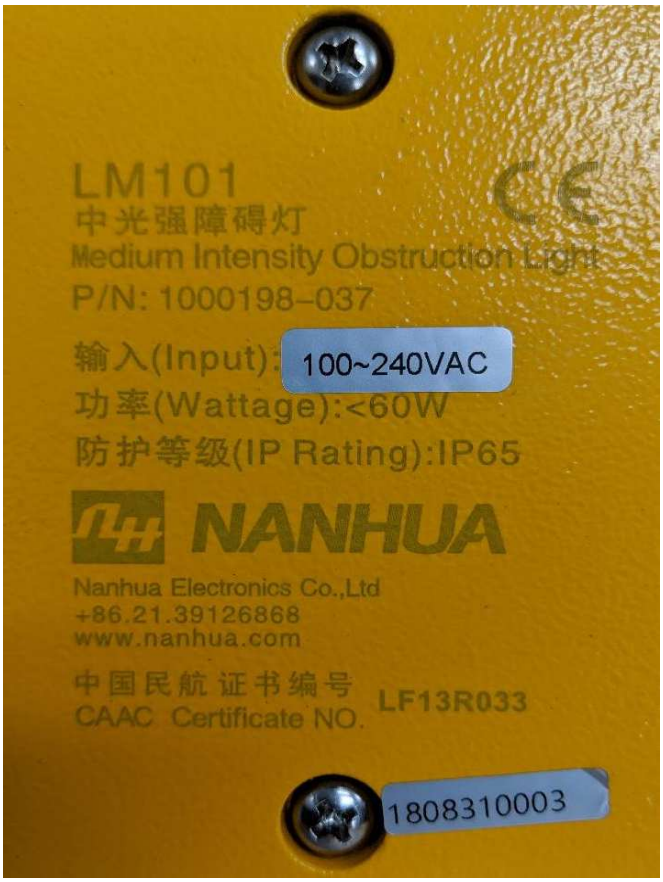
Sample Information				
Date Rec.	**Intertek ID**	**Description**	**Condition**	**Model No.**
4/5/19	CRT1904051325-001	Medium-intensity, Type B	Production	LM101
5/10/19	CRT1905101612-001	Medium-intensity, Type B	Production	LM101

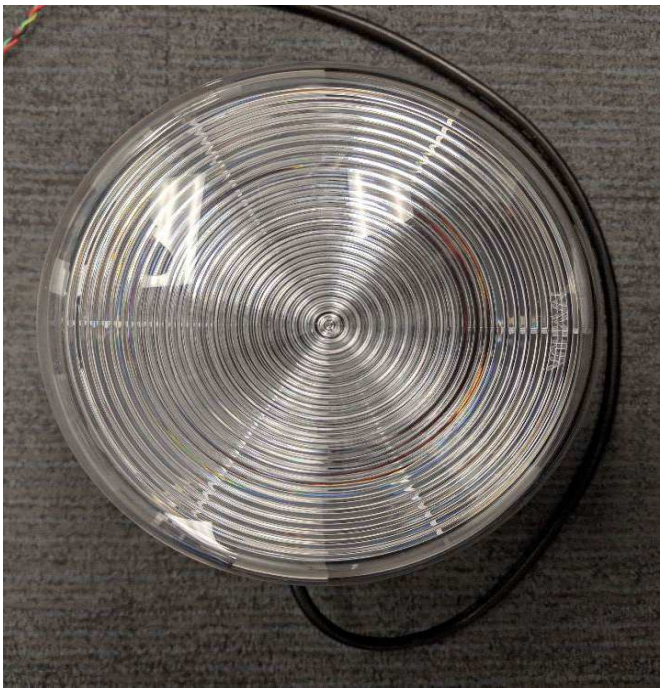
Further Sample Description	
Type:	Medium-intensity, Type B
Options:	None
Light Source:	Cree, 16ct., XPEBRO-L1-0000-00D01, EP-E2
Lens:	Lexan (EXL9330)
Approx Size:	10.75" x 8.25"Ø (lens) - 9.84"Ø (base)
Electrical Input:	100-240Vac
LED Supply Location:	Internal to the flash head
Cable:	NA
Min Cable Length:	NA
Max Cable Length:	NA
Casting Material:	Aluminum
Mounting:	(4) thru-holes for base mounting

Sample Modification Log	
Date	Modification description
4/24/19	Client updated reflector position to comply to photometric distribution requirements.

Sample Information
Picture(s)







Photometry Medium Intensity Type B (Red)

Energize the light by the system power supply and control unit and test for compliance with the photometric requirements in Table 6-3. Vary the input voltage to the light ± 10% from nominal voltage and measure the effective intensity at the input extremes. Make the effective intensity measurements using an integrating photometer whose calibration is traceable to an NIST steady state source. The test distance is 100 feet. The horizontal beam spread is 360 degrees.

Results

ICAO Medium-Intensity, Type B (Red Night)

Table 6-3 Minimum Requirements

Mode	Parameter	Requirement	Measured		Result
Red Night	Flash Rate (FPM)	20-60 FPM	39.7	FPM	Pass
	Min. Avg. Intensity	2,000 cd at 0°	2308	cd	Pass
	Min. Peak Intensity	1,500 cd at 0°	1807	cd	Pass
	Min. Peak Intensity	750 cd at -1°	907	cd	Pass
	Beam Spread	≥3° at each vertical slice (min 750cd)	>4.5	degrees	Pass

Table 6-3 Recommendations

Mode	Parameter	Requirement	Measured		Result
White Night	Max. Intensity	2,500 cd at 0°	2756	cd	Fail
	Max. Intensity	1,125 cd at -1°	1625	cd	Fail
	Max. Intensity	75 cd at -10°	38	cd	Pass

					Minimum Cable Length					
Voltage Variation	Voltage	Position	Measured	Factor	Min. Avg. Int. 2,000cd @ 0°			Min. Peak Int. 1,500cd @ 0°		
Input Voltage	120.1	0,0	11060	NA	2308	cd	Result	1807	cd	Result
Input Voltage +10%	264.0	0,0	11050	100%	2306	cd	Pass	1806	cd	Pass
Input Voltage -10%	90.1	0,0	11070	100%	2310	cd	Pass	1809	cd	Pass

Cable Length (ft.):	NA	Calibration Factor:	2.45*10^-12	Input:	120.1 Vac
Flash Duration (sec):	0.678	Neutral Density Filter:	NA		
Flash Period (sec.):	1.51				

Calculated Effective Intensity Data (candela)

Vertical Position	Horizontal Position (deg.)											
	0	30	60	90	120	150	180	210	240	270	300	330
3U	978	1142	1461	1764	1655	1940	1652	1812	1425	1425	1158	857
2U	1794	2740	2131	3047	2220	3159	2323	3036	2070	2740	2013	2268
1.5U	2136	3088	2555	3293	2646	3341	2689	3316	2393	3091	2341	3186
1U	2546	3296	2689	3332	2676	3205	2708	3382	2651	3268	2683	3209
0	2571	2443	2496	1871	2147	1807	2243	2113	2336	2309	2603	2756
1D	1411	1552	1028	1149	907	1115	941	1217	1053	1354	1297	1625
1.5D	1060	1370	873	1017	745	811	650	752	827	1019	939	1326
2D	905	1035	754	754	631	470	368	492	627	757	827	1046
3D	570	208	279	204	306	142	126	74	226	228	395	414
10D	35	35	34	34	32	31	29	29	28	28	38	36

Complies: ☑ YES ☐ NO

Tested By:	Brittany James			Signature or initials:	BJ
Engineer:	Rudy Sporman			Signature or initials:	RS
Reviewed By:	cwm			Signature or initials:	cwm
Test Equipment Used:	1, 2, 3, 4, 8, 9, 13			Sample No:	CRT1905101612-001
Amb (ºC):	25.4	RH%	38.9	Completion Date:	5/16/2019

Chromaticity ICAO

Test the fixture with the lamp, filter and optical system for color of light emitted. Chromaticity Coordinates are to be calculated from a spectral distribution measured in 2nm increments for LEDs, and 5nm increments for incandescent. Measure the color after stabilization at rated input at the main beam center and beam extremes.

Results - ICAO LED Red

Sample	Color	Input	Location	x	y	z	(P/F)
CRT1904051325-001	Red	120.1Vac	(0,0)	0.667	0.328	0.005	P

The aviation red must be per ICAO Annex 14, Volume 1, Appendix 1, Colors for Aeronautical Ground Lights, within the following chromaticity boundaries

Boundary	Line Equation	Calc.
Purple Boundary	y ≥ 0.980 - x	0.313
Yellow Boundary	y ≤ 0.335	0.328

Complies: ☑ YES ☐ NO

Tested By:	Matthew Benninger			Signature or initials:	MB
Engineer:	Rudy Sporman			Signature or initials:	RS
Reviewed By:	JND			Signature or initials:	JND
Test Equipment Used:	10,11,12,13			Sample No:	CRT1904051325-001
Amb (ºC):	22	RH%	31	Completion Date:	4/10/2019

Equipment list

#	Intertek ID No.	Description	Manufacturer	Calibration Due
1	L178	100ft. Lab Goniophotometer	Labsphere	08-May-2020
2	L061	IL1700 Radiometer	International Light	14-May-2020
3	E538	Oscilloscope	Tektronix	07-Sep-2019
4	N1311	Precision Level	Starrett	10-Sep-2019
5	N1441	Tape Measure	Stanley	15-Jun-2021
6	M245	Multimeter	Fluke	07-May-2019
7	L155	Digital Protractor	Mitutoyo	24-Aug-2019
8	M308	Stopwatch	Traceable	03-Nov-2019
9	M310	Hygro-Thermometer	Testo	16-Nov-2019
10	T1555	Hygro-Thermometer	Extech	03-Jun-2019
11	O109	Goniometer	Optroniks	03-Apr-2020
12	M292	Spectroradiometer	Gooch and Housego	27-Apr-2019
13	M135	Multimeter	Fluke	11-Jan-2020

Note: For measurement uncertainty, refer to the calibration certificates for all the test equipment located in the equipment files