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Report No. 102485491CRT-001

Nanhua Electronics Co. Ltd.

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China

Standards

International Civil Aviation Organization (ICAO), Aerodromes, Annex 14, Volume 1, Seventh Edition, dated July 2016

<i>Test Purpose</i>	International Civil Aviation Organization Compliance Testing
<i>Test Dates</i>	August 2, 2016 - August 31, 2016
<i>Revision Notes</i>	changed client name and address; data correction on page 5; updated specification edition

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Lighting

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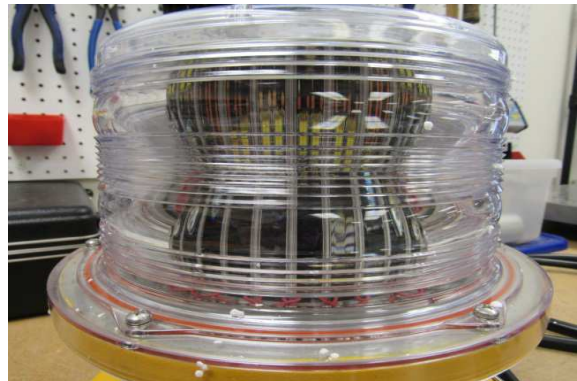
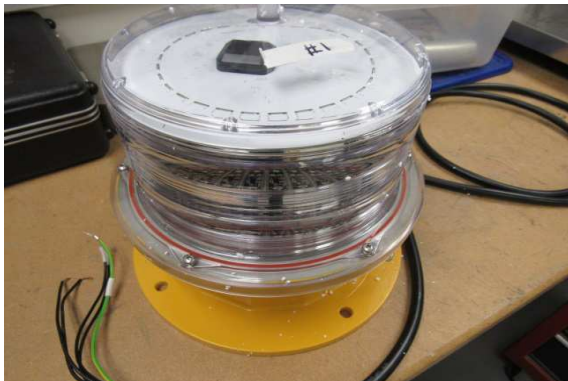
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Test Plan and Datasheets			
Client	Nanhua Electronics Co. Ltd.	Engineer	Ryan Fanelli
Report #	102485491CRT-001	Reviewer	Jeremy Downs
Product	Medium Intensity Obstacle Light	Model(s)	LM40
Standard	ICAO Annex 14, dated July 2016		

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

Sample Information				
Date Rec.	Intertek ID	Description	Condition	Model No.
3/4/16	CRT1602081151-001	Medium Intensity Type A&B	Production	LM40
3/4/16	CRT1602081151-002	Power Supply Box	Production	NA
7/15/16	CRT1607151348-001	Medium Intensity Type A&B	Production	LM40
7/18/16	CRT1607181301-001	Power Supply Box	Production	NA

Further Sample Description	
Type:	ICAO Medium Intensity Type A & B
Class:	NA
Mode:	NA
Style:	NA
Options:	NA
Light Source:	White: LM27-SW57; Red: XLampXPE2
Filter:	Polycarbonate
Diameter:	11 inches
Power Supply:	inside power supply box
Controller:	Inside flash head
Cable Length:	7 feet
Electrical Input:	220V to power supply box
Casting Material:	Aluminum
Yield Device:	NA
Mounting:	(4) bolt holes
Catalog Number:	LM40
Picture(s)	





Photometry Medium Intensity Type A (White)

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 25 meters. The horizontal beam spread is 360 degrees.

Results

Medium-Intensity, Type A (White Day)					
Mode	Parameter	Requirement	Measured		Result
White Day	Flash Rate (FPM)	20-60 FPM	60.0	FPM	Pass
	Min. Avg. Intensity	20,000 cd at 0°	22825	cd	Pass
	Min. Peak Intensity	15,000 cd at 0°	21538	cd	Pass
	Min. Peak Intensity	7,500 cd at -1°	18974	cd	Pass
	Beam Spread	≥3° at each vertical slice (min 7,500cd)	5	degrees	Pass

Mode	Parameter	Reccomendation	Measured		Result
White Day & Twilight	Maximum Intensity	25,000 cd at 0°	24444	cd	NA
	Maximum Intensity	11,250 cd at -1°	22507	cd	NA
	Maximum Intensity	750 cd at -10°	530	cd	NA

					Minimum Cable Length					
Voltage Variation	Voltage	Position	Measured	Factor	Min. Avg. Int. 20,000cd @ 0°		Min. Peak Int. 15,000cd @ 0°			
Input Voltage	220Vac	0, 0	40600	NA	22825	cd	Result	21538	cd	Result
Input Voltage +10%	242.3Vac	0, 0	40700	100%	22881	cd	Pass	21592	cd	Pass
Input Voltage -10%	198.4Vac	0, 0	40600	100%	22825	cd	Pass	21538	cd	Pass

Cable Length (ft):	7	Calibration Factor:	3.66X10-12	Input:	220.3	Vac
Flash Duration (sec):	0.151	Neutral Density Filter:	NA			
Flash Period (sec.):	1					

Vertical Position	Horizontal Position (deg.)											
	0	30	60	90	120	150	180	210	240	270	300	330
3U	7578	8809	8205	6342	7100	7481	8239	11077	9259	8046	8274	8217
2U	15783	13219	12707	12194	12308	12991	13447	13675	13504	12991	12821	12650
1.5U	16182	15670	15670	14986	15442	16182	16695	16923	16695	15613	16296	15670
1U	18917	18006	18746	18120	18689	19544	19886	19886	19373	18689	19088	18746
0	23134	23362	24444	23590	24046	23818	22336	22165	21937	21652	21880	21538
1D	20171	21254	22507	22165	21652	20627	19658	19430	19316	18974	19031	18974
1.5D	18803	19316	21140	21254	21026	19373	18689	18462	17949	17664	18177	17778
2D	17322	18006	18974	17664	17949	18462	17265	17037	16695	16296	17151	17265
3D	10724	14986	13789	14245	13618	11316	9362	9345	9402	11567	9692	10108
10D	493	495	478	517	507	508	530	505	505	493	498	505

Medium-Intensity, Type A (White Night)					
Mode	Parameter	Requirement	Measured		Result
White Night	Flash Rate (FPM)	20-60 FPM	40.0	FPM	Pass
	Min. Avg. Intensity	2,000 cd at 0°	2618	cd	Pass
	Min. Peak Intensity	1,500 cd at 0°	2475	cd	Pass
	Min. Peak Intensity	750 cd at -1°	2193	cd	Pass
	Beam Spread	≥3° at each vertical slice (min 750cd)	5	degrees	Pass

Mode	Parameter	Reccomendation	Measured		Result
White Night	Maximum Intensity	2,500 cd at 0°	2772	cd	NA
	Maximum Intensity	1125 cd at -1°	2559	cd	NA
	Maximum Intensity	75 cd at -10°	120	cd	NA

		Minimum Cable Length								
Voltage Variation	Voltage	Position	Measured	Factor	Min. Avg. Int. 2,000cd @ 0°		Min. Peak Int. 1,500cd @ 0°			
Input Voltage	220Vac	0, 0	12250	NA	2618	cd	Result	2475	cd	Result
Input Voltage +10%	242.0Vac	0, 0	12250	100%	2618	cd	Pass	2475	cd	Pass
Input Voltage -10%	198.2Vac	0, 0	12230	100%	2614	cd	Pass	2471	cd	Pass

Cable Length (ft):	7	Calibration Factor:	3.66X10-12	Input:	220.5 Vac
Flash Duration (sec):	0.7496	Neutral Density Filter:	NA		
Flash Period (sec.):	1.5				

Vertical Position	Horizontal Position (deg.)											
	0	30	60	90	120	150	180	210	240	270	300	330
3U	817	779	769	706	817	874	977	1116	1078	918	931	912
2U	1434	1441	1401	1354	1403	1489	1559	1588	1550	1474	1449	1411
1.5U	1771	1740	1731	1681	1750	1853	1940	1963	1917	1773	1845	1761
1U	2127	1999	2089	2039	2131	2247	2308	2296	2226	2138	2188	2193
0	2580	2645	2772	2681	2759	2738	2584	2519	2511	2475	2553	2605
1D	2317	2454	2559	2553	2496	2372	2277	2220	2211	2193	2224	2209
1.5D	2171	2235	2428	2454	2420	2266	2161	2102	2056	2035	2106	2058
2D	2001	2064	2188	2355	2260	2119	1997	1927	1685	1885	1999	2001
3D	1316	1636	1662	1689	1611	1441	1099	1630	1091	1144	1179	1247
10D	108	110	105	109	106	111	114	120	29	110	28	111

Notes: The maximum cable length was not provided.

Complies: YES NO

Tested By:	Matthew Benninger	Signature or initials:	mb	Comp. Date:	8/2/16
Reviewed By:	JND	Signature or initials:	JND		
Test Equipment Used:	1,2,3,4,5	Sample:	CRT1607151348-001		
Amb (°C):	26	RH%:	71%		

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 $\pm 10\%$ 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 25 meters. The horizontal beam spread is 360 degrees.

Results

Medium-Intensity, Type B (Red Night)					
Mode	Parameter	Requirement	Measured		Result
Red Night	Flash Rate (FPM)	20-60 FPM	40.3	FPM	Pass
	Min. Avg. Intensity	2,000 cd at 0°	2234	cd	Pass
	Min. Peak Intensity	1,500 cd at 0°	2074	cd	Pass
	Min. Peak Intensity	750 cd at -1°	791	cd	Pass
	Beam Spread	$\geq 3^\circ$ at each vertical slice (min 750cd)	3	degrees	Pass

Mode	Parameter	Reccomendation	Measured		Result
Red Night	Maximum Intensity	2,500 cd at 0°	2440	cd	NA
	Maximum Intensity	1125 cd at -1°	1495	cd	NA
	Maximum Intensity	75 cd at -10°	71.0	cd	NA

Minimum Cable Length										
Voltage Variation	Voltage	Position	Measured	Factor	Min. Avg. Int. 2,000cd @ 0°		Min. Peak Int. 1,500cd @ 0°			
Input Voltage	220Vac	0, 0	10580	NA	2234	cd	Result	2074	cd	Result
Input Voltage +10%	242.4Vac	0, 0	10600	100%	2239	cd	Pass	2078	cd	Pass
Input Voltage -10%	198.2Vac	0, 0	10600	100%	2239	cd	Pass	2078	cd	Pass

Cable Length:	7	Calibration Factor:	3.66X10-12	Input:	220.3 Vac
Flash Duration (sec.):	0.751	Neutral Density Filter:	NA		
Flash Period (sec.):	1.49				

Vertical Position	Horizontal Position (deg.)											
	0	30	60	90	120	150	180	210	240	270	300	330
3U	612	589	557	555	559	591	620	631	688	683	644	616
2U	1476	1356	1142	984	944	1026	1268	1350	1474	1268	1291	1373
1.5U	2189	2229	1977	1476	1495	1935	2160	2124	2118	1996	2128	2240
1U	2562	2564	2532	2410	2433	2381	2444	2397	2303	2309	2566	2463
0	2225	2280	2440	2164	2221	2351	2288	2271	2168	2074	2206	2126
1D	898	948	1312	1495	1352	1037	837	791	816	862	824	805
1.5D	597	614	780	930	890	700	648	616	635	648	648	591
2D	492	492	528	631	616	570	532	509	501	522	526	507
3D	354	355	349	427	425	400	399	376	349	381	375	419
10D	64	71	69	68	68	71	69	71	65	69	63	65

Notes: The maximum cable length was not provided.

Complies: YES NO

Tested By:	Matthew Benninger	Signature or initials:	mb	Comp. Date:	8/2/16
Reviewed By:	JND	Signature or initials:	JND		
Test Equipment Used:	1,2,3,4,5	Sample:	CRT1607151348-001		
Amb (°C):	26	RH%:	71%		

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.

Measurements

With filter

Sample	Color	Input	Location	x	y	z
CRT1607151348-001	Red	220VAC	(0,1.5)	0.687	0.313	0.000
			(0,0)	0.685	0.315	0.000
			(0,-1)	0.687	0.313	0.000

Sample	Color	Input	Location	x	y	z	Color Temp(K)
CRT1607151348-001	White	220VAC	(0,3)	0.3462	0.3659	0.2879	4634
			(0,0)	0.3369	0.3512	0.3119	4619
			(0,-3)	0.3589	0.3725	0.2686	4609
			(0,-3)	0.3325	0.3394	0.3281	5496

Results

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

Red			
Boundary	Line Equation	Calc.	(P/F)
Purple Boundary	$y \geq 0.980 - x$	0.293	Pass
Yellow Boundary	$y \leq 0.335$	0.313	Pass

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

White LED			
Boundary	Line Equation	Calc.	(P/F)
Yellow Boundary	$x < 0.440$	0.337	Pass
Blue Boundary	$x > 0.320$	0.337	Pass
Green Boundary	$y < 0.150 + 0.643x$	0.364	Pass
Purple Boundary	$y > 0.050 + 0.757x$	0.305	Pass

Complies: YES NO

Tested By:	Matthew Benninger	Signature or initials:	MB	Comp. Date	8/17/16
Reviewed By:	JND	Signature or initials:	JND		
Test Equipment Used:	1,2,3,6	Sample:	CRT1607151348-001		
Amb (°C):	25	RH%	61	Red Chromaticity	

Tested By:	Matthew Benninger	Signature or initials:	MB	Comp. Date	8/31/16
Reviewed By:	JND	Signature or initials:	JND		
Test Equipment Used:	1,2,3,6	Sample:	CRT1607151348-001		
Amb (°C):	22	RH%	62	White Chromaticity	

Equipment list				
#	Intertek ID No.	Description	Manufacturer	Calibration Due
1	O109	Goniometer	Optroniks	06-Oct-2016
2	T1555	Hygro-Thermometer	Extech	03-May-2017
3	M135	Multimeter	Fluke	04-Apr-2017
4	L061	IL1700	International ight	26-Oct-2016
5	E466	Oscilloscope	Tektroniks	13-Jul-2017
6	O757	PR-740	Photo Research	3/23/2017
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Note: For measurement uncertainty, refer to the calibration certificates for all the test equipment located in the equipment files