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Report No. 103379350CRT-001

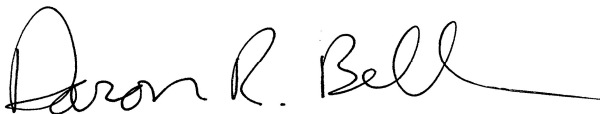
Shanghai Nanhua Electronics Co., Ltd.

Building #9
1755 Wenbei Road, Jiading
Shanghai 201802
China

Standards

International Civil Aviation Organization (ICAO), Aerodromes, Annex 14, Volume 1, Sixth Edition, dated July 2013

<i>Test Purpose</i>	ICAO Photometry and Chromaticity Performance Testing
<i>Test Dates</i>	February 28th 2018 through February 28th 2018
<i>Revision Note</i>	Client Address Updated



Daron R. Bell
Project Engineer
Lighting



Christopher W. Metcalf
Engineering Supervisor
Lighting

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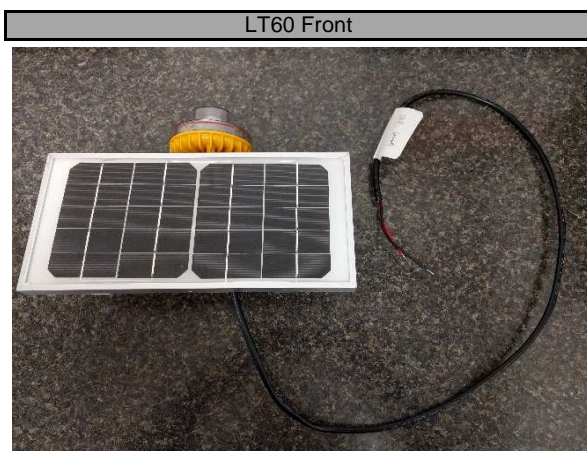
Test Plan and Datasheets			
Client	Shanghai Nanhua Electronics Co., Ltd.	Engineer	Daron R. Bell
Report #	103379350CRT-001	Reviewer	Christopher W. Metcalf
Product	Low Intensity Type A	Model(s)	LT60
Standard	ICAO Annex 14, dated July 2013		

Spec	Test name	Clause	Pass Fail NA
ICAO	Photometry Low Intensity Type A	Table 6-1	Pass
ICAO	Chromaticity ICAO App. 1 2.2.1	2.1.1	Pass
ICAO	Photometry Medium Intensity Type B	Table 6-3R	NA
ICAO	Chromaticity ICAO App. 1 2.2.1	2.1.1	NA

Sample Information				
Date Rec.	Intertek ID	Description	Condition	Model No.
2/12/18	CRT1802121346-001	LT60 Low Intensity Type A	Production	1000114-001

Further Sample Description	
Type:	Low Intensity Type A
Options:	Solar Panel
Light Source:	1 x CREE Model XPEBRD
Filter:	Polycarbonate
Diameter:	3.5"
Electrical Input:	7.2 VDC (300 mA) Supplied by client
Casting Material:	Aluminium
Yield Device:	NA
Mounting:	NPS 1" Diameter

Picture(s)



Photometry

Energize each light fixture and test for compliance with the photometric requirements. Operate the fixture until stabilized before taking measurements. Each light will be measured independently while steady burning.

Results

Sample	Voltage Variation	Voltage	Position	Measured	Factor	Result
CRT1802121346-001	Input Voltage*	7.20	(0,0)	46.56	NA	NA
	Input Voltage +10%	7.92	(0,0)	47.93	103%	Pass
	Input Voltage -10%	6.48	(0,0)	47.92	103%	Pass

* Distribution test voltage

Luminous Intensity (cd)												
Vertical Position (deg.)	Horizontal Position (deg.)											
	0	30	60	90	120	150	180	210	240	270	300	330
16.5	3.9	3.1	2.9	3.1	3.2	3.0	3.1	3.5	4.5	3.3	3.6	4.6
16.0	3.9	3.1	3.1	3.1	3.3	3.1	3.2	3.6	5.1	3.8	3.7	5.9
15.5	3.9	3.2	3.2	3.1	3.3	3.1	3.4	3.8	7.0	5.0	4.3	7.8
15.0	4.2	3.2	3.3	3.1	3.4	3.2	3.4	3.9	9.5	6.6	4.9	9.9
14.5	4.5	3.4	4.1	3.3	3.5	3.4	3.6	4.1	11.8	9.9	5.5	11.9
14.0	6.1	3.5	4.8	3.4	3.7	3.7	4.2	4.6	15.1	14.8	8.4	14.4
13.5	9.9	3.7	6.4	3.6	3.8	4.9	4.7	5.1	17.4	19.4	15.2	17.3
13.0	14.1	4.1	8.8	3.8	4.1	7.1	5.2	5.7	19.0	23.9	22.3	19.6
12.5	18.0	6.2	11.0	4.1	4.5	9.4	8.5	7.5	20.6	29.2	29.2	22.9
12.0	22.5	11.6	13.8	4.8	5.0	12.0	12.5	15.0	22.1	34.2	35.2	26.0
11.5	26.4	17.0	16.5	6.3	5.5	15.2	14.9	22.5	27.4	36.1	42.7	28.8
11.0	30.6	22.5	18.9	10.8	7.5	17.8	18.7	35.2	40.9	42.2	50.0	33.1
10.5	35.3	27.5	22.2	15.2	14.7	21.9	30.1	45.0	55.1	50.5	61.1	36.7
10.0	39.3	31.5	25.4	19.9	25.0	29.6	44.2	60.8	67.8	57.0	72.1	46.0
9.5	51.4	38.7	29.5	26.7	38.7	40.7	57.4	76.1	73.4	68.0	78.8	60.2
9.0	62.4	50.7	38.2	42.8	50.6	52.0	69.8	82.4	73.1	74.5	85.6	71.3
8.5	73.4	62.7	49.5	55.1	65.0	60.0	71.2	84.5	74.5	78.9	82.8	78.2
8.0	85.8	75.0	60.8	65.6	73.7	66.2	71.4	84.1	73.1	80.9	77.0	82.3
7.5	85.9	78.9	72.1	80.3	82.7	67.1	70.5	80.9	75.1	79.5	74.3	80.6
7.0	81.8	82.9	73.9	84.8	80.4	70.3	72.6	84.8	79.9	78.6	75.8	83.7
6.5	82.0	82.3	76.4	83.8	77.5	70.4	76.8	81.9	80.7	77.7	73.3	87.6
6.0	79.7	79.8	77.9	85.8	81.2	73.9	78.5	81.3	84.0	76.1	73.6	86.2
5.5	82.8	79.6	77.4	82.6	81.7	74.5	82.5	82.3	88.0	76.9	75.8	88.9
5.0	84.6	82.7	82.8	83.7	81.9	78.1	81.0	78.6	83.2	74.2	73.8	87.2
4.5	83.9	80.1	85.3	83.7	83.8	80.8	82.0	79.4	82.0	71.0	73.5	83.5
4.0	83.2	80.5	87.4	82.8	82.5	81.3	79.6	77.0	80.8	71.8	71.2	82.9
3.5	81.5	81.7	90.4	84.5	82.8	83.0	79.1	73.0	73.1	66.4	68.4	75.2
3.0	75.9	78.1	87.6	82.5	81.8	80.6	75.0	73.6	69.0	60.6	65.0	67.5
2.5	73.9	79.9	86.1	78.0	76.2	81.2	71.9	69.5	62.6	55.7	58.0	61.7
2.0	68.3	77.2	86.1	80.0	76.4	76.4	70.3	64.2	55.5	47.8	49.5	55.9
1.5	62.4	68.9	81.1	75.8	76.5	75.1	65.2	62.1	52.0	44.8	44.7	52.0
1.0	57.0	66.3	73.6	73.0	72.7	69.2	62.6	54.3	49.1	44.4	44.6	45.3
0.5	49.2	59.1	69.0	71.7	71.2	66.9	56.9	54.1	46.9	42.1	43.1	40.4
0.0	46.6	51.6	61.5	65.9	67.7	62.5	56.4	51.9	43.4	39.9	42.1	40.9

-0.5	46.8	49.4	56.7	63.1	62.3	60.5	52.3	47.7	37.5	35.4	38.3	40.0
-1.0	43.0	47.5	54.1	60.0	61.3	57.1	49.8	44.7	34.7	33.5	36.6	36.6
-1.5	39.3	47.1	50.8	56.0	57.6	53.6	45.8	41.1	33.8	31.5	32.5	34.0
-2.0	35.1	43.5	48.6	54.1	54.2	48.8	41.2	38.1	30.0	27.9	28.0	30.2
-2.5	32.6	37.8	44.7	50.9	52.2	42.5	38.2	34.9	27.4	24.3	24.9	28.1
-3.0	29.9	35.1	39.2	46.6	47.0	39.2	33.5	29.9	24.3	22.2	21.8	25.9
-3.5	26.8	32.4	36.8	43.9	43.4	35.1	31.0	26.2	20.1	20.2	20.7	24.2
-4.0	24.2	27.7	33.3	40.0	39.9	32.2	26.9	22.3	18.2	16.2	16.5	21.4
-4.5	22.5	24.5	29.0	34.2	33.7	27.8	23.5	18.4	15.2	14.8	15.5	18.1
-5.0	17.0	22.3	26.3	30.7	29.6	25.1	18.7	16.3	15.3	12.4	12.5	16.2
-5.5	16.0	18.3	23.1	25.6	25.7	21.6	16.6	14.7	12.5	9.3	9.5	14.4
-6.0	14.5	17.2	19.0	22.4	22.7	19.3	14.3	10.5	9.7	9.0	8.5	11.0
-6.5	11.0	15.0	18.3	21.4	20.7	16.1	10.0	10.0	9.4	8.9	7.4	10.2
-7.0	10.3	11.0	14.0	15.7	14.8	11.7	8.6	9.6	9.1	8.1	6.2	9.7
-7.5	9.4	10.0	11.2	13.3	11.8	10.3	7.7	8.9	8.2	7.4	5.3	8.9
-8.0	9.0	9.2	10.2	11.5	11.2	9.5	6.6	8.4	7.7	6.3	4.5	7.6
-8.5	7.8	8.3	8.5	10.2	10.4	8.7	5.7	8.2	6.7	5.2	3.9	6.8
-9.0	6.8	8.0	7.5	9.2	9.2	7.9	5.6	6.9	5.5	4.1	3.3	5.8
-9.5	5.5	6.9	6.5	7.7	7.9	7.5	4.7	5.5	4.0	3.3	2.8	4.8
-10.0	4.3	5.8	5.7	6.8	6.8	6.5	3.8	4.1	3.1	2.5	2.2	3.7
-10.5	3.4	4.7	4.6	5.8	6.6	5.5	3.0	3.3	2.7	2.3	2.2	2.9
-11.0	3.0	3.7	3.8	4.7	5.2	4.1	2.8	2.9	2.4	2.3	2.2	2.6
-11.5	2.7	3.1	3.3	3.6	3.9	3.4	2.7	2.6	2.1	2.1	2.3	2.4
ICAO Low-intensity Type A (fixed obstacle)												
Min 2°-10°	39.3	31.5	25.4	19.9	25.0	29.6	44.2	60.8	55.5	47.8	49.5	46.0
Upper (°)	14	12.5	13.5	11.5	12	13	13	13.5	16	15.5	14.5	16
Lower (°)	-9.5	-10	-10	-10.5	-11	-10.5	-9	-9.5	-9	-8.5	-7.5	-9
Spread (°)	24	23	24	22	23	24	22	23	25	24	22	25

Complies: YES NO

Tested By:	Clay Fickenscher	Signature or initials:	<i>CF</i>	Comp. Date	2/28/18
Reviewed By:	cwm	Signature or initials:	<i>cwm</i>		
Test Equipment Used:	1,2,3,4				
Amb (°C):	23	RH%:	29		

Chromaticity

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 warm-up period at rated input at the main beam center and beam extremes.

Results

Sample	Color	Input	Location	x	y	z
CRT1802121346-001	Red	7.20Vdc	(0,10)	0.671	0.328	0.001
			(0,8)	0.671	0.328	0.001
			(0,6)	0.671	0.328	0.001

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

Boundary	Line Equation	Calc.
Purple Boundary	$y \geq 0.980 - x$	0.309
Yellow Boundary	$y \leq 0.335$	0.328

Complies: YES NO

Tested By:	Matthew Benninger	Signature or initials:	<i>WPB</i>	Comp. Date	2/28/18
Reviewed By:	cwm	Signature or initials:	<i>cwm</i>		
Test Equipment Used:	1, 4, 5				
Amb (°C):	22	RH%	29		

Equipment list				
#	Intertek ID No.	Description	Manufacturer	Calibration Due
1	O109	Goniometer	Optronik	04-Oct-2018
2	O114	5M Photometer	Optronik	22-Oct-2018
3	O113	Power Supply	Optronik	13-Apr-2018
4	T1555	Hygro-Thermometer	Extech	16-May-2018
5	M292	OL750S	Gooch & Housego	26-Sep-2018
6	E288	OL-750 Spectroradiometer	Optronic Laboratories	20-Mar-2018
7	M282	Hygrometer	Testo	08-Apr-2018
8	E536	Digital Power Meter	Yokogawa	19-Jan-2019
9	N721	Steel Ruler	Products Engineering Corp	12-Jul-2019
10	N1335	Tape Measure	Stanley	16-May-2019
11	E499	Digital Level	Smart Tool	22-Jun-2018
12				
13				
14				
15				
16				
17				
18				
19				
20				

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