NVLAP LAB CODE 200707-0

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

P.Q.L., Inc.

2285 Ward Avenue o Simi Valley, CA 93065

Test Model: 83670

Report Type:	Electrical and Photometric tests including: Luminous Flux, Color, Luminous Intensity Distribution
Test Engineer:	Daniel Duan
Report Number:	R2KS151229051-10
Test Date:	2015-12-31 to 2016-01-03
Report Date:	2016-01-11
Reviewed By:	Jeanne Han/Safety Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008
Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.
Accreditation:	The NVLAP Lab Code is 200707-0.

1. Product Description

General Information:

One sample was received on 2015-12-29 and used for testing.

Model Tested:	83670
Manufacturer:	P.Q.L., Inc.
Brand Name:	P.Q.L., Inc.
Product Designation:	Linear Retrofit Kit
Burning Time Before Test:	0hour(For New Products)

Rated Values:

Rated Voltage/Frequency:	120 V AC 60Hz
Rated Power:	20 W
Nominal CCT:	4000 K
Nominal Lumen Output:	2450 lm(For Linear Retrofit Kit)

2. Standards Used

- IESNA LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products
- ANSI C82.77-2002: Harmonic Emission Limits – Related Power Quality Requirements for Lighting

3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integrating Sphere	SENSING	SPR-600	S09008	25～50℃	2015-03-25	2016-03-24
Spectral photometer	SENSING	SPR3000	90902027	350nm～800nm	2015-03-25	2016-03-24
Power Meter	YOKOGAWA	WT-210	91j926132	15/30/60/150/300/600 V	2015-03-05	2016-03-04
AC Power Supply	ALL Power	APW-105N	970663	220V±10% 50HZ	2015-03-05	2016-03-04
Standard Light Source	EVERFINE	D204	01331191	24V/100W	2015-08-27	2016-08-26
Thermal Meter	SENSING	N/A	N/A	25、50℃	2015-03-05	2016-03-04
DC Power Supply	ITECH	IT6154	0061 0417 6471 0010 19	0~32V	2015-03-05	2016-03-04
AC Power Supply	EVERFINE	VPS1030 PWM	1012017	0-150V， 0-300V	2015-03-05	2016-03-04
DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2015-03-05	2016-03-04
Power Meter	YOKOGAWA	WT-210	91KB35700	15/30/60/150/300/600 V	2015-03-05	2016-03-04
Goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2015-04-21	2016-04-20
Wireless Remote Sensor	N/A	433MHz	N/A	0℃~50℃;-20℃~60℃	2015-03-23	2016-03-22
Standard Light Source	EVERFINE	D908	1012003	N/A	2015-09-08	2016-09-07

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

4. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with IES LM-79-08. The product was operated at rated voltage or at voltage required by manufacturer. The ambient temperature of the sample was maintained at 25°C±1°C during measurement. And relative humidity is less than 65%.

Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, spectrophotometer, and integrating sphere. The integrating sphere system is calibrated by standard light source before measurement.

4π geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the light output (luminous flux) measurements is U=2.1% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=32K (K=2), at the 95% confidence level. The uncertainty of the CRI is U=2.1 (K=2) , at the 95% confidence level.

The uncertainty of power meter AC current U=0.19 % of rdg, AC Voltage U=0.15% of rdg, Power U=0.20%) (K=2), at the 95% confidence level.

Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the luminous intensity is U=2.82% (K=2) , at the 95% confidence level.

5. Test Result

[Integrating Sphere System]

Total operating time for integrating sphere test: **1.0 hour**

Test orientation: **Downward**

Electrical Measurement

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
120.06	60	0.181	21.52	0.989

Photometric Measurement

Luminous Flux (lm)	Radiant Flux (W)	Efficacy (lm/W)	CCT (K)	Duv
1963.99	5.921	91.263	3922	0.0009

Chromaticity Coordinate

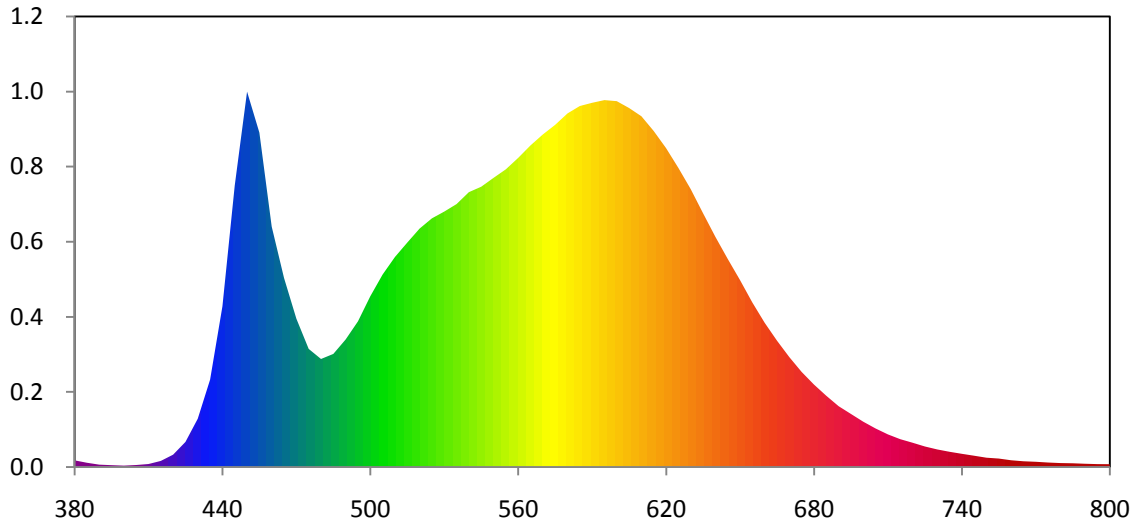
x	y	u	v	u'	v'
0.3847	0.3813	0.2261	0.3361	0.2261	0.5042

Color Rendering Index

Ra
82.8

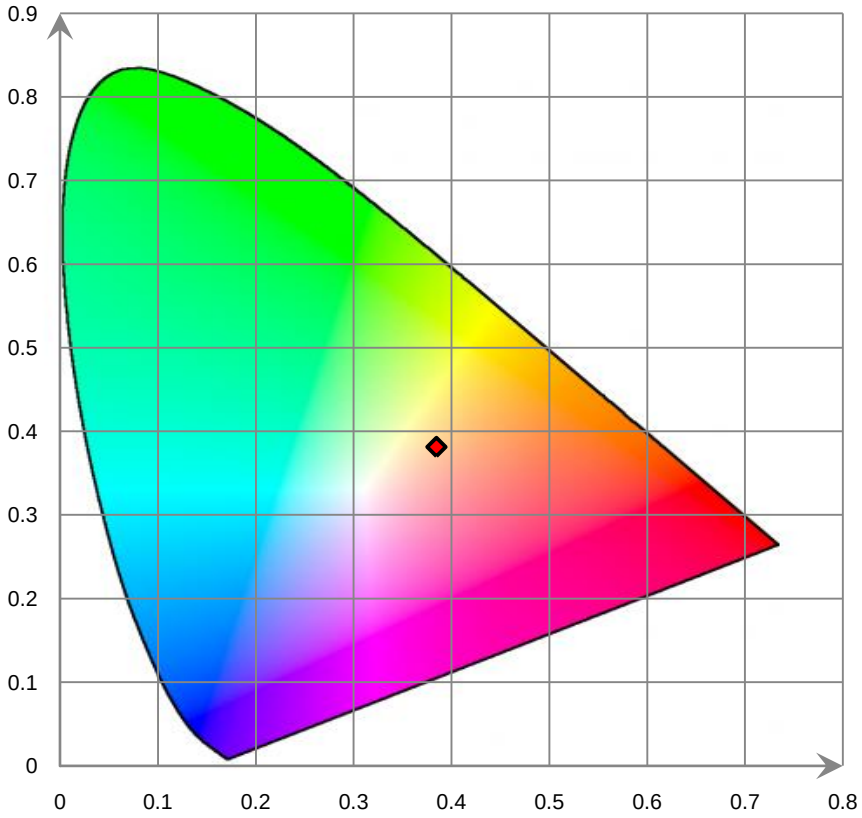
R1	R2	R3	R4
81	89	95	82
R5	R6	R7	R8
81	85	86	64
R9	R10	R11	R12
7	75	80	62
R13	R14	R15	
84	97	75	

Relative Spectral Power Distribution

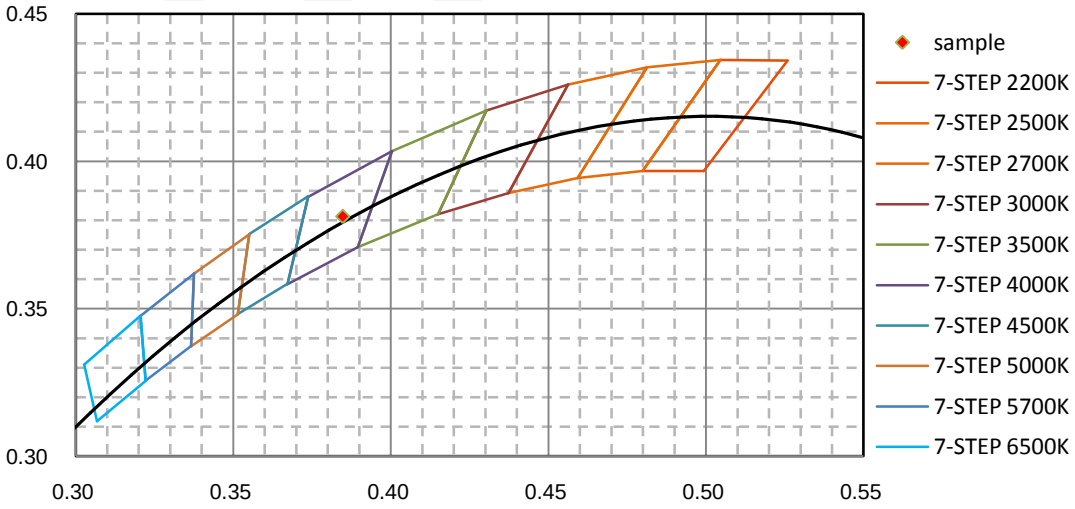


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	1.969E-03	465	5.467E-02	550	8.359E-02	635	7.338E-02	720	7.061E-03
385	1.275E-03	470	4.290E-02	555	8.606E-02	640	6.657E-02	725	5.978E-03
390	7.322E-04	475	3.417E-02	560	8.936E-02	645	6.019E-02	730	5.125E-03
395	5.780E-04	480	3.126E-02	565	9.297E-02	650	5.406E-02	735	4.445E-03
400	4.416E-04	485	3.272E-02	570	9.613E-02	655	4.758E-02	740	3.862E-03
405	6.193E-04	490	3.690E-02	575	9.891E-02	660	4.172E-02	745	3.306E-03
410	9.046E-04	495	4.213E-02	580	1.022E-01	665	3.655E-02	750	2.734E-03
415	1.799E-03	500	4.938E-02	585	1.044E-01	670	3.181E-02	755	2.488E-03
420	3.615E-03	505	5.566E-02	590	1.053E-01	675	2.752E-02	760	1.995E-03
425	7.290E-03	510	6.073E-02	595	1.061E-01	680	2.388E-02	765	1.701E-03
430	1.400E-02	515	6.489E-02	600	1.058E-01	685	2.063E-02	770	1.551E-03
435	2.530E-02	520	6.894E-02	605	1.038E-01	690	1.762E-02	775	1.335E-03
440	4.646E-02	525	7.189E-02	610	1.014E-01	695	1.538E-02	780	1.188E-03
445	8.139E-02	530	7.385E-02	615	9.712E-02	700	1.314E-02		
450	1.085E-01	535	7.602E-02	620	9.217E-02	705	1.117E-02		
455	9.665E-02	540	7.946E-02	625	8.646E-02	710	9.465E-03		
460	6.951E-02	545	8.103E-02	630	8.033E-02	715	8.088E-03		

CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



[Goniophotometer System]

Total operating time for luminous intensity distribution: **1.0 hour**

Test orientation: **Downward**

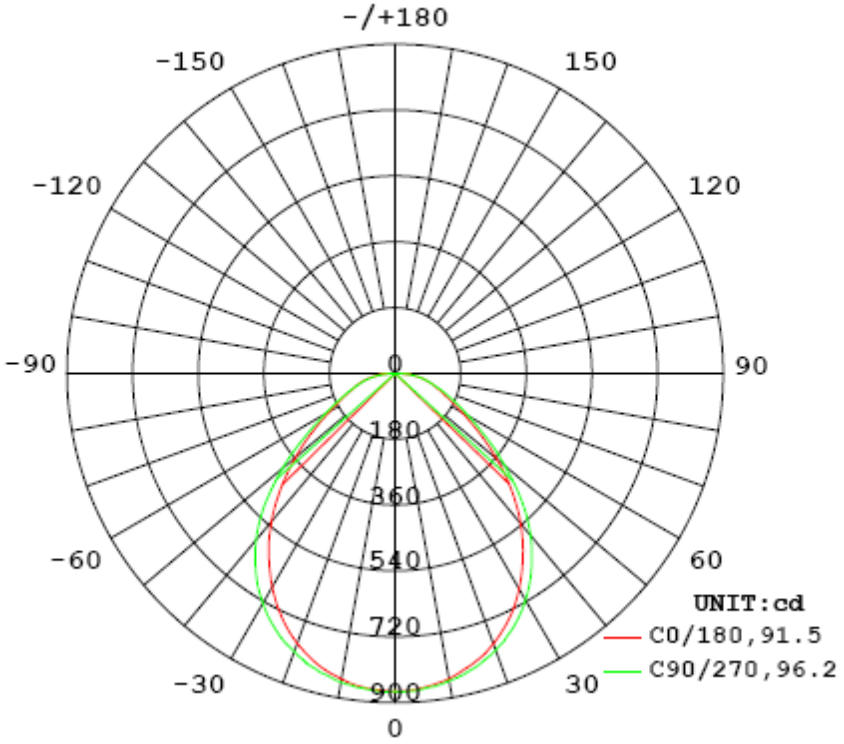
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
119.93	60	0.181	21.5	0.9904

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1972.11	91.73	871.1	1.17	1.23

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% Imax):	91.5	93.0	96.2	93.0	93.4
Field Angle (10% Imax):	154.9	148.0	153.7	147.7	151.1

Luminous Intensity (cd) Distribution Data

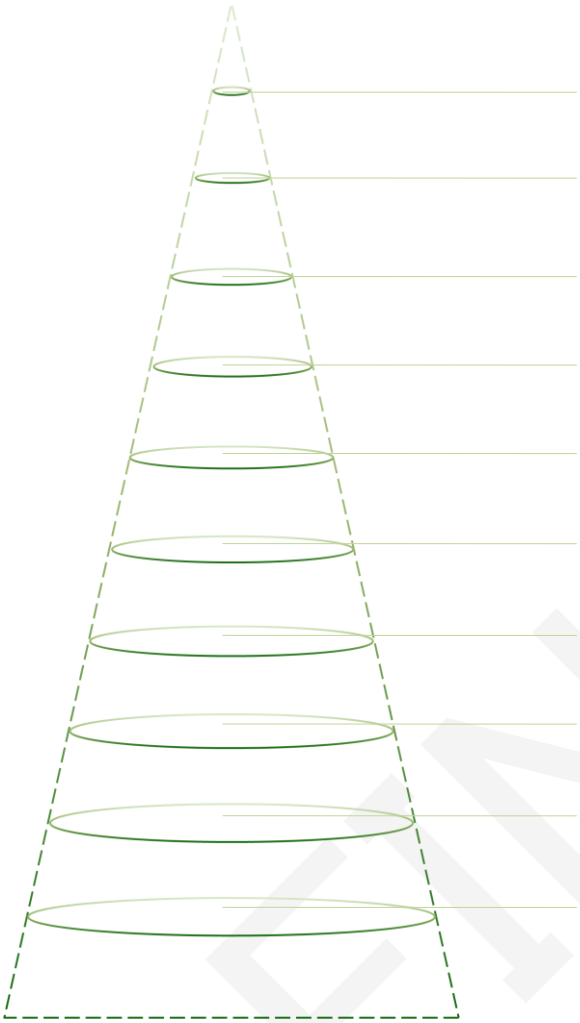
C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	869	869	869	869	869	869	869	869
5.0°	864	867	865	866	866	865	864	865
10.0°	848	851	851	854	857	854	851	850
15.0°	823	827	830	835	837	835	830	826
20.0°	786	790	797	806	809	806	798	791
25.0°	736	745	752	767	774	768	755	746
30.0°	675	680	697	716	726	717	702	687
35.0°	605	610	630	654	666	656	635	620
40.0°	528	536	550	579	594	580	559	545
45.0°	444	449	462	489	506	493	471	460
50.0°	357	358	372	395	403	396	380	368
55.0°	276	275	289	298	304	299	295	283
60.0°	207	204	206	212	223	213	210	210
65.0°	158	154	143	153	167	154	146	158
70.0°	125	121	103	115	126	116	105	124
75.0°	99	94	79	88	95	89	80	97
80.0°	72	68	60	61	66	62	62	70
85.0°	37	37	30	27	28	29	32	39
90.0°	4	4	0	0	0	0	0	1
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	1	0	1	1	1	1	1	0
110.0°	1	0	1	1	1	1	0	0
115.0°	1	0	1	1	1	1	0	0
120.0°	1	0	1	1	1	1	0	0
125.0°	1	1	1	1	1	1	1	0
130.0°	1	1	1	1	1	1	1	0
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	1	1	1	1	1	1	1	1
155.0°	1	1	1	1	1	1	1	1
160.0°	1	1	1	1	1	1	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	1	1	1	1	1	1	1	1
180.0°	1	1	1	1	1	1	1	1

Luminous Intensity (cd) Distribution Data (cont.)

C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	869	869	869	869	869	869	869	869
5.0°	862	864	864	865	866	866	864	863
10.0°	848	851	849	852	853	851	850	849
15.0°	822	824	826	830	835	830	826	823
20.0°	787	790	794	801	806	801	794	786
25.0°	740	744	752	760	766	760	749	737
30.0°	680	685	695	708	715	707	690	674
35.0°	611	615	627	644	652	642	620	603
40.0°	536	536	548	567	578	565	540	525
45.0°	452	450	460	479	490	476	452	439
50.0°	364	365	375	389	393	386	368	355
55.0°	281	285	295	300	305	297	288	277
60.0°	211	216	219	222	232	218	214	210
65.0°	161	166	159	166	178	163	155	161
70.0°	127	130	116	127	135	124	112	126
75.0°	100	98	86	96	100	94	84	96
80.0°	73	69	64	68	73	67	62	68
85.0°	38	39	35	36	38	35	33	37
90.0°	0	0	0	0	0	0	0	0
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	0	0	0	0	0	0	0	0
110.0°	0	0	0	0	1	0	0	0
115.0°	0	0	0	1	1	1	0	0
120.0°	0	0	0	1	1	1	1	0
125.0°	0	0	0	1	1	1	1	0
130.0°	0	1	1	1	1	1	1	1
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	1	1	1	1	1	1	1	1
155.0°	1	1	1	1	1	1	1	1
160.0°	1	1	1	1	1	1	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	1	1	1	1	1	1	1	1
180.0°	1	1	1	1	1	1	1	1

Average Area Illumination Figure

Angle:93.4°. Flux out:1315.0 lm



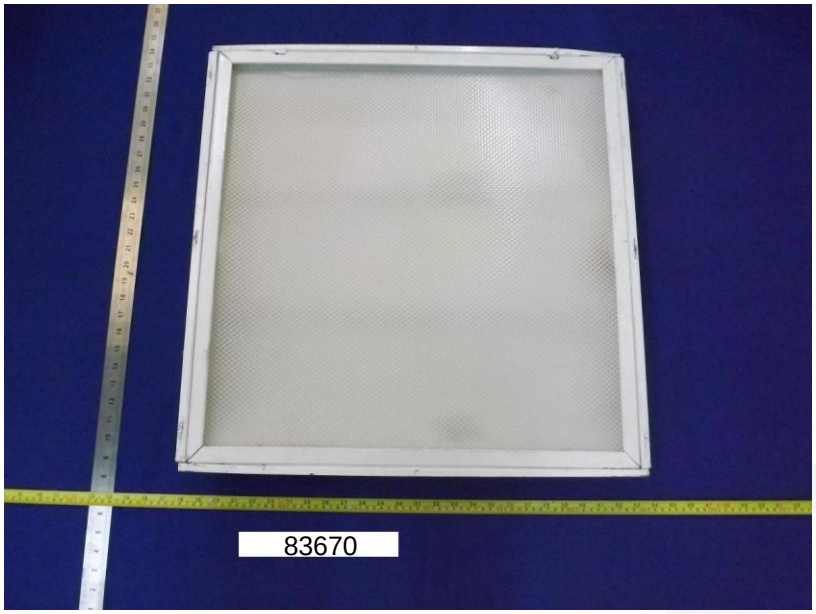
Height (m)	Diameter (cm)	E_{avg}(lx)	E_{max}(lx)
0.5	106.12	1456.0	3479.0
1.0	212.23	364.0	869.8
1.5	318.35	161.8	386.6
2.0	424.47	91.0	217.5
2.5	530.59	58.2	139.2
3.0	636.70	40.4	96.7
3.5	742.82	29.7	71.0
4.0	848.94	22.8	54.4
4.5	955.06	18.0	43.0
5.0	1061.17	14.6	34.8

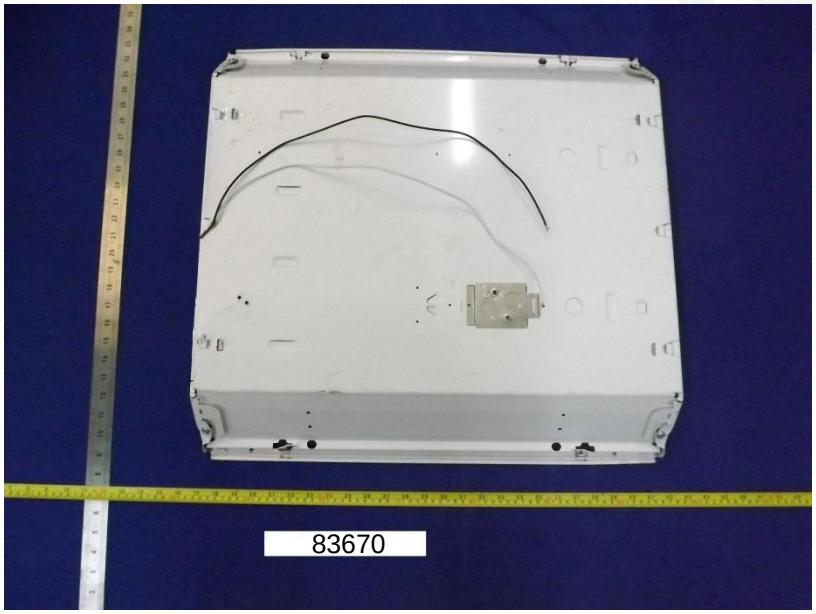
Zonal Lumen Density Measurement

Deg	Flux (lm)	%
0-5	20.7	1.05
5-10	61.4	3.11
10-15	99.7	5.06
15-20	134.0	6.79
20-25	162.5	8.24
25-30	183.6	9.31
30-35	195.6	9.92
35-40	197.7	10.02
40-45	189.1	9.59
45-50	170.1	8.63
50-55	144.7	7.34
55-60	115.7	5.87
60-65	89.7	4.55
65-70	70.2	3.56
70-75	55.3	2.80
75-80	42.5	2.16
80-85	27.8	1.41
85-90	8.3	0.42
90-95	0.1	0.01
95-100	0.2	0.00
100-105	0.2	0.01
105-110	0.2	0.02
110-115	0.2	0.01
115-120	0.2	0.01
120-125	0.2	0.01
125-130	0.2	0.02
130-135	0.2	0.01
135-140	0.2	0.01
140-145	0.2	0.01
145-150	0.2	0.01
150-155	0.2	0.01
155-160	0.2	0.01
160-165	0.1	0.01
165-170	0.1	0.01
170-175	0.1	0.00
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	20.7	1.05
0-10	82.1	4.16
0-15	181.8	9.22
0-20	315.7	16.01
0-25	478.3	24.25
0-30	661.9	33.56
0-35	857.5	43.48
0-40	1055.1	53.50
0-45	1244.2	63.09
0-50	1414.4	71.72
0-55	1559.1	79.06
0-60	1674.9	84.93
0-65	1764.6	89.48
0-70	1834.8	93.04
0-75	1890.1	95.84
0-80	1932.7	98.00
0-85	1960.5	99.41
0-90	1968.7	99.83
0-95	1968.9	99.84
0-100	1969.0	99.84
0-105	1969.2	99.85
0-110	1969.5	99.87
0-115	1969.7	99.88
0-120	1970.0	99.89
0-125	1970.2	99.90
0-130	1970.4	99.92
0-135	1970.7	99.93
0-140	1970.9	99.94
0-145	1971.1	99.95
0-150	1971.4	99.96
0-155	1971.6	99.97
0-160	1971.8	99.98
0-165	1971.9	99.99
0-170	1972.0	100.00
0-175	1972.1	100.00
0-180	1972.1	100.00

6. Product Photo





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